THE THEORY OF POPULATION

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ESSAYS IN MARXIST RESEARCH

Edited by

Professor D. I. VALENTEY

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ТЕОРИЯ НАРОДОНАСЕЛЕНИЯ
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THE AUTHORS

E. A. ARAB-OGLY
V. V. BODROVA
A. Y. BOYARSKY
F. BURGCHARDT (GDR)
L. Y. DARSKY
Y. N. GUZEVATY
B. S. KHOREV
G. M. KOROSTELEV
S. A. KOVALEV
V. P. KOVALEVSKY
V. I. KOZLOV
A. Y. KVASHA
A. M. MERKOV
A. A. MINTS
L. OSADNIK (GDR)
N. V. PANKRATYEVA
V. V. POKSHISHEVSKY
E. ROSSET (POLAND)
R. S. ROTOVA
Y. G. SAUSHKIN
B. Y. SMULEVICH
A. P. SUDOPLATOV
V. A. SYSENKO
E. SZABADI (HUNGARY)
B. T. URLANIS
D. I. VALENTEY
E. VALKOVICS (HUNGARY)
A. G. VOLKOV

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FOREWORD

This work presents the results of a major project in population studies undertaken by social and natural scientists under the auspices of the Centre for Population Studies of the Economics Faculty of Moscow State University.

The authors have reached very interesting conclusions meriting serious consideration from their analysis of the objective laws and patterns of population development, and their perfecting of the methodology of studying socio-demographic processes. Effective treatment of population problems calls for joint work by a broad circle of social and natural scientists from several fields, and will continue to do so. Only in that way can really new results be obtained in the field of theory and methodology, particularly in studying the interrelations of economic and demographic processes in developed socialist society. Such an approach will make it possible to consolidate the social and economic basis for forecasting population; and the significance of demographic forecasting in macro-economic planning practice can hardly be exaggerated.

The institution of the scientific specialities of population economics and demography—an outcome of the active theoretical work of Soviet demographers—imposes great obligations on scientists concerned with population studies. And it opens up broad prospects for new creative work in developing Soviet science.

Academician *S. Strumilin*

INTRODUCTION

D. I. Valentey, D. Sc. (Econ.)

Karl Marx and Frederick Engels created a scientific theory of population based on the firm foundation of dialectical materialism and on the laws of social development discovered by them, above all on the laws of movement of social production.

This theory underwent further development in the hands of Lenin who already in his earliest works was treating population problems.[1] Later he returned many times to study of population, and of various aspects of these matters, stressing the importance of analysis of problems of the development of society.

In several works, including some written after the October Revolution, Lenin analysed fundamental questions of the theory and methodology of population studies.[2]

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[1] See V. I. Lenin. *Collected Works*, Progress Publishers, Moscow, Vol. 1. New Economic Developments in Peasant Life (pp. 11-73); On the So-Called Market Question (pp. 75-125); What the "Friends of the People" Are and How They Fight the Social-Democrats (pp. 129-332); The Economic Content of Narodism and the Criticism of It in Mr. Struve's Book (pp. 333-507).

[2] See V. I. Lenin. *Collected Works*, Vol. 2. A Characterisation of Economic Romanticism (pp. 129-265); Vol. 3. The Development of Capitalism in Russia (pp. 21-607); Vol. 5. The Agrarian Question and the "Critics of Marx" (pp. 103-222); Vol. 13. The Agrarian Question and the "Critics of Marx" (pp. 169-216); Vol. 15. The Agrarian Question in Russia towards the Close of the 19th Century (pp. 69-147); Vol. 22. New Data on the Laws Governing the Development of Capitalism in Agriculture (pp. 13-102); Vol. 23. Statistics and Sociology (pp. 271-77).

Lenin studied the role of population as the natural precondition of the social development of the working people, and as the primary productive force of all mankind, in connection with the development of the whole system of productive forces and relations of production in regard to different stages of human history.

No aspect of population development escaped his notice. The attention he paid to social mobility of the population and to the factors governing it is well known. By analysing the changes in social structure of the population during the development of society, he demonstrated (in addition to developing several new approaches to analysing the social structure of the population of prerevolutionary Russia) the basic population problems of each of the socio-economic formations, and the effect of the relations of production on a population differentiated by classes and social groups.

The central task in studying population development is to bring out the regularities governing the process. Lenin's works contain the methodological principles for properly comprehending the current population problems of developing countries; for bringing out the true motives inspiring modern apologists of capitalism to look for a "demographic" way of resolving the socio-economic problems of those countries; and for understanding the place of the population problem among the other very important problems of the modern world. Lenin's theory of imperialism provides the theoretical basis for concluding that the monopolies of the industrial capitalist countries of Europe and America are doing everything they can to keep the developing countries in the position of raw material appendages of the advanced capitalist countries. Modern bourgeois demographers are encouraging this by their practical activity when they try to depict the socio-economic phenomena in developing countries as allegedly natural and eternal, and unavoidable on the road of anti-imperialist struggle and revolutionary transformation.

Lenin paid great attention to analysing various forms of population movement, including various forms of migration, and especially the resettlement of population within Russia, and the movement of rural population to the towns.

He analysed each of the three forms of movement distinguished by our demographers and the development of population as a whole, determined his attitude to the intensity of the natural population movement of various social groups, and demonstrated the class essence of the problems.

In his work Lenin also theoretically substantiated the most important aspects of the evolution of settlements as the productive forces and relations of production develop, and wrote about the laws and patterns of the new distribution of population inherent in socialist society during its moulding and advance in connection with the perfecting of the productive forces.

In analysing each of the matters examined here, which are an integral part of Lenin's theoretical legacy, it is not difficult to see how he continued, from work to work, to develop and deepen his understanding of the problems, constantly examining population questions in connection with the concrete historical conditions of social life. That applied to the workers' working and living conditions, the employment of women and their position in social life, family relations, problems of nutrition and health, and many other matters concerning the life and development of man, the living productive force.

An historical approach to the analysis of the laws of population was always typical of Lenin.

The founders of Marxism-Leninism defined the place of population in social development and material production, indicated and analysed the population problems of the various socio-economic formations, showed the historical nature of the laws of population, brought out the stage patterns in its development, and worked out a really scientific methodology for comprehending the objective processes of this development. The works of Marx, Engels, and Lenin contain a well-argued critique of various bourgeois theories, still widely held today with modifications of one kind or another.

Soviet scientists, basing themselves on the classical works of Marxism-Leninism, the decisions of congresses of the Communist Party of the Soviet Union and fraternal Parties, and the works of leaders of the Party and of the international communist movement, are developing the Marxist-Leninist theory of population, a theory based on

a very important methodological point of departure, which consists in treating population as a social phenomenon subject to the laws of social development, and at the same time as the most important condition for the material life of society and the basis and the subject of all social production.

This point of departure follows directly from the doctrine of dialectical materialism. The Marxist dialectical method is an expression of the patterns of development of nature and society as a single whole, the many-sided parts of which are mutually conditioned, and are in a state of development. Its point of departure is that knowledge corresponds to nature and to history. Soviet demographers start from these positions in their understanding of the role of population in the development of society.

Population, possessing a natural determinateness, is one of the starting points in social and economic research. It is always kept in mind as the precondition of any social process, and as such is always in our consciousness. The approach to population as the natural basis of social production—the main one, along with the geographical, environmental conditions of society's material life—not only does not negate the possibility and necessity of the socio-economic aspect, but assumes it. People capable of purposive labour activity are the main productive force of society, breathing life into the other elements of production.

The job of the Marxist-Leninist theory of population is to disclose the effect of the productive forces and of the relations of production on the working and living conditions that govern the reproduction of people, and on the regularities of population development. The subject matter of research inevitably, in connection with the specific character of population itself, embraces a great many problems. Social mobility, the natural replacement of generations, migration processes, the settlement of population, changes in its qualitative characteristics (including general educational and vocational training, and its state of health) occupy an exceptional place.

Historical materialism defined the decisive role of the direct producers of material wealth, the working masses, in the history of social development; and that is of para-

mount importance for the methodology of understanding the laws of population in various historically changing social conditions, which are moulded by the influence of the class dominant at a given stage, and are created through the action of the mode of production dominant at the given stage of social development.

Changes in the structure of a population are ultimately determined by the social organisms that are created on the basis of the prevailing relations of production. The very term "socio-economic aspect of population development" suggests the mutual influence of social and economic conditions on changes in its structure; and the indicators of the movement of population and their trends must be taken into account in socialist society in planning the economy and socio-economic measures.

Population can be studied on a global scale, or by continents or countries, or by the constituent parts of countries, or by rural areas and towns. By population is to be understood the aggregate of the people carrying on their life activity within a certain society. Population is always a complex and multiform aggregate of the people living in a given area and forming the natural basis of a given social community. In the process of production people enter into social relations of production among themselves which may, depending on the mode of production prevailing in that society, be relations of the dominance of some and the subordination of others (antagonistic class formations), or relations of the comradely co-operation and mutual assistance of equal individuals (communism in both its phases), or transitional from the first form of relations to the second.

At a given level of the productive forces the able-bodied population is an important factor that largely determines the scale of social wealth and the opportunities for further economic development in both agriculture and industry. The size of a population undoubtedly influences the pace of social development, delaying it or speeding it up. Data on the natural movement of population, however, do not explain the structure of society or the causes of the transition from one historical formation to another. The size and density of a population, as the founders of Marxism-Leninism showed, do not

determine the character of the social system, nor are they the decisive factor in social development.

When bourgeois sociologists attribute decisive significance in social development to population growth, they pursue an exclusively apologetic aim of masking the contradictions and ulcers of capitalism. Thus the social Darwinist Herbert Spencer asserted that population growth in itself, by bringing about changes in people's conditions of existence, forced them to adapt themselves in a new fashion to the environment and to alter the social order. The Russian bourgeois historian Maxim Kovalevsky said in his *Economic Growth of Europe before the Rise of Capitalism* that the forms of the national economy did not arbitrarily follow one another but were governed by a certain law of succession; but the most important factor in their evolution at any given time and in any given country, he stated, was the growth, and the greater or lesser density, of the population. Such views were also held by the French sociologist J. Stoetzel and the American Raymond Pearl and his followers.

The force determining the character of a social system, and the pace and character of social development, is the production of material wealth carried on by people within definite social relations. This great discovery of Marx's and Engels', brilliantly developed by Lenin, has been fully confirmed by the whole course of mankind's historical development.

Spokesmen of bourgeois scientific circles accuse Marxism-Leninism of allegedly underrating the role of population in the development of society's productive forces, and some would have us believe that Marxists approach the theory of population from a technocratic position; but all assertions of that kind will not stand up to criticism.

In countries where socialism has been or is being built, the people's working and living conditions, man and his growing needs, occupy the centre of attention, as follows from the substance of the basic economic law of socialism and is confirmed by the whole experience of building communism in the Soviet Union and other socialist countries. Further clear confirmation of this are the results of the completion of the Ninth Five-Year Plan for the development of the Soviet economy (1971-

75), reported to the 25th CPSU Congress in February 1976. The Congress particularly noted progress in resolving the main task, that of "raising the living standards of the people". In noting the progress made, the Congress pointed out that "new possibilities are thereby being created for the solution of the basic socio-economic problems set in the Party Programme and by the last few congresses. This concerns, notably, a *further rise of the Soviet people's well-being, an improvement of the conditions of their work and everyday life, and considerable progress in public health, education and culture, in fact everything that helps to mould the new man, the harmoniously developed individual, and improve the socialist way of life.*"[1]

Works devoted to a Marxist political, economic and social analysis of a country begin with a survey of its territory and population, thereby emphasising the unquestioned fact that population is the basis of social production. But such an approach to study of the politico-economic aspect of a country still does not characterise the essence of Marxism, for it is essentially the path that political economy has followed in its evolution. One of Marx's outstanding contributions was that he provided the initial material for a proper methodology of understanding the role of population in social production.

Analysis of population would be fruitless if it were made outside the concrete social medium, outside the class structure of society, outside the forms of property and of economic interrelations, the character of the division of labour, and so on. Out of context the concept "population" itself is as much an abstraction as the concept "production" in general. "The population is an abstraction if I leave out, for example, the classes of which it is composed."[2]

A population divided into classes exists under certain social relations and contains numerous and conflicting relations of an economic, political, national, religious, and family order. It is a complex aggregate with numer-

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[1] *Documents and Resolutions. XXV Congress of the CPSU*, Novosti Press Agency Publishing House, Moscow, 1976, pp. 43, 48.

[2] Karl Marx. *Grundrisse der Kritik der Politischen Ökonomie.* Translated by Martin Nicolaus. Penguin Books, London, 1973, p. 101.

ous determinations and relations (the form of ownership dominant in society and determining the character of labour; the social division of labour; the relations of distribution and consumption; the situation and living conditions of the labouring masses) and the many relations derived from them. In a second return to population, consequently, it appears as a rich ensemble considered in its numerous relations, above all in the relations of social production, distribution, and consumption. This second return to population as to a rich and complex ensemble in the social process of production is also the subject of study of social science.

People enter into social relations and connections in the process of production, and because of that their relations with nature are determined, and production carried on, within the framework of these social connections. The job of a Marxist-Leninist theory of population is to disclose the effect of the productive forces and relations of production on the conditions of a population's life, work, and reproduction at the various stages of human development. In addition to these two aspects, which characterise population as an element of the productive forces and as the bearer of relations of production, there is, however, a third aspect, inherent in it, namely, reproduction of the population itself. "The third circumstance which, from the very outset, enters into historical development, is that men, who daily re-create their own life, begin to make other men, to propagate their kind," Marx and Engels wrote in *The German Ideology*.[1]

The first two aspects of the social life of a population are quite fully and thoroughly studied by political economy, philosophy, and other social sciences; but Soviet science only recently began to study the reproduction of population as the "production of man himself", as perpetuation of the species. The fundamental task on this plane is to bring out the pattern of development of the population of each of the social formations, to indicate the role of the demographic factor in economic development and the mutual conditionality of the unity

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[1] Karl Marx, Frederick Engels. The German Ideology, *Collected Works*, Vol. 5, Progress Publishers, Moscow, 1976, p. 42.

of material production and of the production of life itself. Analysis of the population laws themselves is decisive for investigation of the patterns of development of a population, because the concept "law" is one of the stages in man's understanding of the unity and connection, interdependence and wholeness of the general process of the production of life itself, governed in each period by definite historical factors.

"...In fact every special historic mode of production has its own special laws of population, historically valid within its limits alone."[1] The economic law of population of capitalism, as the law of relative surplus population, was discovered by Marx. In this connection Lenin wrote that Marx's theory "merely requires that the 'labour problem'—since it only exists as such in capitalist society—be solved not on the basis of 'general investigations' into human reproduction, but on the basis of specific investigations of the laws of capitalist relations".[2]

Marxist-Leninist theory makes it possible to understand the laws of population, and under the communist mode of production to apply them consciously for the benefit of society. Every historical social formation has its own specific population laws, proper to it; and since that is so, one must study the special laws for the primitive communal, slave-owning, feudal, capitalist, and communist modes of production.

Bourgeois sociologists and demographers, in accusing Marxists of allegedly separating the development of society from the development of nature, themselves distort the truth. Marxists consider history a unity of nature and society, because nature conditions both the origin and the whole life of human society. "...The history of nature and the history of men are dependent on each other so long as men exist," Marx and Engels wrote.[3] With the appearance of man a qualitatively new pattern of the development of nature was created. This applies

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[1] Karl Marx. *Capital*, Vol. I, Progress Publishers, Moscow, 1974, p. 592.

[2] V. I. Lenin. The Economic Content of Narodism..., *Collected Works*, Vol. 1, p. 454.

[3] Karl Marx, Frederick Engels. The German Ideology, *Collected Works*, Vol. 5, p. 28.

primarily to human society, but is not limited solely to it, since man is not a detached contemplator of the world around him but actively intervenes in it.

"An abstract law of population exists for plants and animals only, and only in so far as man has not interfered with them," Marx wrote in *Capital*.[1] In *Dialectics of Nature* Engels noted that "the most that the animal can achieve is to *collect*; man produces.... This makes impossible any unqualified transference of the laws of life in animal societies to human ones."[2] Lenin stressed that one could not consider reproduction as a tendency the same for plants, animals, and man.[3]

It has been shown that the fecundity rates of plants and animals are an adaptive characteristic and develop in dependence on diverse conditions of existence. F. A. Lange, and following him, P. B. Struve, tried to attribute to Marx an affirmation of the abstract character of the multiplication of plants and animals; Lenin's comment, however, was that Lange "simply did not understand the meaning of Marx's statement", and had built all his lecturing of Marx on that basis[4].

In speaking of the abstract law of population of plants and animals, Marx, it is important to note, never asserted that they had an unlimited tendency to multiply. The reproduction of domesticated animals and of plants cultivated by man (domestic cattle, poultry, and cereals) is conditioned to a considerable degree by purely economic considerations, and functions as a quantity depending on the demand or the social conditions prevailing in society. In trying to explain the regularities of the natural population movement existing in human society, one cannot base oneself on the same postulates as are used in studying reproduction in the vegetable and animal kingdoms, where the conditions of existence alter very slowly, and in fact have undergone no change during the whole history of human society.

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[1] Karl Marx. *Capital*, Vol. I, p. 592.

[2] Frederick Engels. *Dialectics of Nature*. Translated and edited by Clemens Dutt. Preface and Notes by J. B. S. Haldane, F.R.S., London, Lawrence and Wishart, 1940, p. 209.

[3] See V. I. Lenin. The Economic Content of Narodism..., *Collected Works*, Vol. 1, pp. 453-54.

[4] *Ibid.*

Marx counterposed man to the animal kingdom, showing, in particular, that man produced material wealth in different social organisms that followed one after the other, and were governed by the mode of production dominant at the given stage of historical development. This proposition is very important for determining the methodology for understanding the patterns of reproduction of human population, which do not resemble those of multiplication in the animal and vegetable kingdoms although they have (and that must never be forgotten) a common biological basis.

In developing Marx's position Lenin noted that "the conditions for human reproduction are directly dependent on the structure of the different social organisms; that is why the law of population must be studied in relation to each organism separately, and not 'abstractly', without regard to the historically different forms of social structure".[1] Material production presupposes the production of life itself, of means of subsistence, of changes in the environment, of man himself. The materialist conception of the patterns of social development devotes special attention to the problems of population and to the patterns of its development.

Demographic processes are the natural basis of population development, they are constant in their social and biological conditionality, but are inconstant under the impact of the environment and of living and working conditions, which in turn are determined by the level of development of the productive forces and of the economic relations prevailing in society.

Being social in their essence, demographic processes manifest themselves with different intensities as a result of development of the mode of production, which also, to a certain extent, affects the development of the productive forces.

The movement of demographic characteristics and of changes in the structure of a population are determined by social organisms that are formed on the basis of the prevailing relations of production; but a certain inertia of demographic processes leads to their degree of change

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[1] *Ibid.*

not coinciding in time with the moulding of a formation or with its replacement by a new one

It must be borne in mind that there is a whole number of "intermediate" links between a change in the standard of well-being and demographic factors, and the connection must not be understood in an oversimplified way suggesting that a change in the present structure will cause an immediate change, on the same scale, in demographic processes. In this case Marx abstracted such mediating factors as national traditions and customs, the cultural standards of the population and the structure of material and cultural needs, and the legal norms and religious dogmas that are reflected in settled opinions on natality, i.e., that exert an undoubted influence on the moulding of demographic behaviour in the different social groups of a population. As to the correlation of mortality and standard of living, the undoubted dependence of its intensity on social and economic factors is very directly traceable.

In speaking of the decisive dependence of the movement of demographic indicators on the social and economic organisation of society, one cannot, however, attribute all causes of changes in them to the mode of production dominant at any stage of social development. Social mobility, natural movement, and migration are due in the long run to the social relations that develop on the basis of the level of the productive forces achieved.

In addition, the birth rate is a socio-biological category and depends, in society and in the family, on a vast number of factors. Among them the following are of great importance: the age of marrying; family regulation of the number of children; the number of unmarried women; sterility; the stillborn birth rate, and so on. But these are not the sole factors affecting the birth rate. The social position of women plays an enormous role; so, too, do the degree to which the material and cultural needs of the population are met, the cultural standards of the parents and their general example, legislation reflecting one policy or another in regard to population, the effect of war, the level of infant mortality, national features of demographic behaviour, the development of urban life, and other natural and social factors.

The Marxist dialectical method of analysing population problems presupposes all-round examination of each separate case of interrelated social and economic phenomena, and of the political, cultural, juridical, religious, and everyday factors determining the movement of demographic indicators. The economic determination of demographic laws in no way excludes the need to take into account the effect of the elements (drought, floods), of biological factors (epidemics), and of superstructural factors (wars). And here, it must be remembered, the superstructure, and in certain cases other factors, are themselves due to the socio-economic conditions of social life.

In this connection Engels wrote: "According to the materialist conception of history, the *ultimately* determining factor in history is the production and reproduction of real life. Neither Marx nor I have ever asserted more than this. Hence if somebody twists this into saying that the economic factor is the *only* determining one, he transforms this proposition into a meaningless, abstract, absurd phrase....

"Marx and I are ourselves partly to blame for the fact that the younger people sometimes lay more stress on the economic side than is due to it. We had to emphasise the main principle *vis-à-vis* our adversaries, who denied it, and we had not always the time, the place or the opportunity to give their due to the other factors involved in the interaction.... Unfortunately, however, it happens only too often that people think they have fully understood a new theory and can apply it without more ado as soon as they have assimilated its main principles, and even those not always correctly. And I cannot exempt many of the more recent 'Marxists' from this reproach, for the most amazing stuff has been produced in that quarter, too...."[1]

In Marxist-Leninist population theory the range of questions determining the position of the bulk of the population occupies a special place; these are satisfaction of workers' needs and the development, intellectual and physical, both of themselves and of their children,

[1] Frederick Engels. Letter to Joseph Bloch in Königsberg. In: Karl Marx and Frederick Engels. *Selected Correspondence*, Progress Publishers, Moscow, 1975, pp. 394, 396.

and of the adolescents who have not yet reached working age, and of the elderly and aged who have ceased to work.

In the slavery system, for example, degradation of the labourer was characteristic, in accordance with the predominant relations of production, i.e., degradation of the slave to a "speaking tool". Though they were the creators of all wealth, the great masses of the slaves were deprived of the chance to live and work as human beings; the main problem of that socio-historical formation, as regards population, was consequently rooted objectively in slavery. It was resolved by the revolutionary replacement of the slave system by feudalism.

The main socio-economic population problem of feudal society was serfdom. The objective needs of social and economic development led with time to the revolutionary replacement of feudal relations by capitalist ones. The basic population problem of capitalist society is rooted in the exploitation of wage labour by the owners of the means of production.

The October 1917 Revolution in Russia, which put an end to capitalism once and for all, resolved this basic population problem in the Soviet Union. As a result of the victory of the Soviet people over German fascism and Japanese militarism, a number of countries in Europe and Asia were able to abolish the capitalist order and to resolve their basic social population problems. The population problems of the countries that have taken the road of building socialism and communism are being resolved in the course of further development of the productive forces and improvement of the relations of production.

Creative application of Marxist-Leninist theory to analyse population laws and problems helps us to clarify the position of the population, and of its most active part, the working people, to elucidate its real problems and prospects, and to develop a proper methodology for analysing demographic phenomena. The mechanism of many demographic phenomena around which polemics have raged in recent years was explained by the founders of Marxism-Leninism. In particular, Marx and Engels never wrote of an incompatibility of their theoretical positions with the problems of family birth control,

stressing that the latter was the personal affair of each family.

Soviet demographers, sociologists, economists and statisticians, psychologists and doctors not only do not exclude the need for thorough study of the broad range of population problems, but are doing everything necessary to make such a study. Their work is elucidating the dependence of the character of many of the patterns in the life of the people on socio-economic phenomena. They are deeply interested in the problems arising in connection with changes in the age composition of the population, and the effect of many factors like housing, family income, etc., on the birth rate; problems of the distribution of population over the country; the movement of population from rural areas to the cities; the extraordinary concentration of great masses of the population in big cities; and the effect of all these factors on natality.

The development of socialist society also gives rise to an objective need for ever fuller satisfaction of the constantly growing material and cultural requirements of all members of society, and to real possibilities of meeting them. This stems organically from the building in the USSR of a developed socialist society characterised by transformation of the Soviet economy into "an interconnected economic complex embracing the economies of the Republics and being developed by a single state plan".[1] The immense tasks were posed by the 25th Congress of the CPSU of ensuring constantly rising incomes and standards of consumption, solution of the housing problem, further provision of amenities and services, and a broad programme directed to the bringing up from early childhood of a strong, healthy young generation, harmoniously developed in mind and body.

In recent years no little has been done by political economists and specialists in a number of concrete fields of economics, geographers, ethnologists, and other social and natural scientists to develop Soviet demography, and to investigate a broad range of population problems. But life requires more.

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[1] *On Preparations for the 50th Anniversary of the Formation of the Union of Soviet Socialist Republics.* Resolution of the Central Committee of the CPSU, Moscow, 1972, p. 16 (in Russian).

The 25th Congress of the CPSU noted in particular, in delineating the roads for further development of socialist society, that Soviet scientists and scholars must not ignore the population problems that have been becoming acute in recent years. It pointed out that an important job of Soviet science was to work out an effective demographic policy.[1]

Implementation of the Congress' decisions will require a deepening and broadening of research into population problems, a marked rise in its quality, and intensification of its practical value. Soviet demographers are called upon, together with other scientists, to inquire into and generalise demographic processes more deeply and thoroughly, both those in the world as a whole and those taking place in separate countries. Study of the socialist and advanced capitalist countries, and especially of the developing countries, from this aspect must be intensified. The job of Soviet demographers, along with other scientists, is to demonstrate that only a radical socio-economic reconstruction of the world, the triumph of socialism and communism, will ensure solution of the demographic problems facing humanity. Their task is to continue and deepen the critique of all bourgeois and other distortions of population problems, and to demonstrate the theoretical inadequacy and bankruptcy of these theories.

In addition, it follows directly from the decisions of the Congress that one of demography's most important and urgent tasks is to make a thorough, detailed, and far-reaching study of the population problems of the USSR. The Congress clearly defined the main content and end result of fulfilment of that task, namely, the working out of an effective demographic policy.

In the light of the Congress' decisions it becomes particularly important to continue developing the theoretical problems of demography, above all to deepen and develop the Marxist-Leninist theory of population as regards the problems of developed socialist society building communism, and of current world development.

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[1] See *Documents and Resolutions. XXV Congress of the CPSU*, p. 88.

Section One

REGULARITIES OF DEMOGRAPHIC PROCESSES

Chapter 1

HISTORICAL LAWS OF POPULATION DEVELOPMENT

D. I. Valentey, D. Sc. (Econ.),
G. M. Korostelev, D. Sc. (Philos.),
V. I. Kozlov, D. Sc. (Hist.), and
N. V. Pankratyeva, Cand. Sc. (Econ.)

Historical materialism distinguishes three groups of laws: (a) general sociological laws that operate throughout mankind's history; (b) laws characteristic of certain socio-economic formations; and (c) laws characteristic of one socio-economic formation, or even of a definite period within a formation.

The development of population, while subject to the operation of these three types of law, proceeds at the same time in accordance with its own specific laws. Population development processes have numerous essential links that are governed by numerous laws, and laws, moreover, of a different order of generality. The difficulty in understanding the development patterns of population is that most of these laws manifest themselves through the conscious activity of people, taking shape as the resultant of millions of human acts.

In understanding these patterns it is necessary first of all to note their inner organic link with a concrete socio-economic formation and with the system of specific economic laws determining the features and qualitative peculiarity of that formation. That, of course, does not exclude the existence of regularities that are characteristic of several formations, or of the whole period of human history, and affect the specific forms in which the patterns of population inherent in one formation or another only are manifested.

There are no grounds, naturally, for saying that all the laws or patterns of population development have been discovered. Apart from certain ones that have been more or less precisely formulated and determined, the others have only been intuitively "sniffed out".

The economic law of population of capitalism was discovered by Karl Marx and formulated in Chapter XXIII of the first volume of *Capital* as the law of relative surplus population. Soviet scientists are trying to arrive at a definition of the economic population law of socialism, which is seen at its clearest in the definitions of V. A. Boldyrev, T. N. Medvedeva, V. N. Yagodkin, and several other economists, who have formulated it as the law of full employment and rational utilisation of the able-bodied population in social production.

While the economic laws of population are the subject matter of political economy, the patterns of reproduction are the subject matter of demography. Particular difficulties arise in analysing these patterns since demographic processes, because they possess a certain inertia, are not confined to the periods of the dominance of any one mode of production.

The mode of production, too, governs the patterns of settlement, but their study is the subject matter of population geography; and it also presents certain requirements to the population as the basis for forming manpower resources. One has to recognise as law-governed the changes in the features of a population characteristic of some one period of human history, such as education, culture, occupational and special training. The pattern of the qualitative changes in population is the subject matter of a whole series of social sciences (political economy, demography, and others). The pattern of population development is also manifested in regularities in the changes in its state of health in the broadest sense of the concept, which are primarily the subject matter of public health and social hygiene.

A number of the laws and patterns of population development, it must be recognised, operate as trends or tendencies. How far these objective tendencies manifest themselves and are converted into objective patterns depends on the social and economic conditions of societal

development, and on the concrete historical "background" on which they are manifested.

The patterns of population development, like all other objective regularities, operate independently of whether or not they are cognised. Their inner connections and mutual conditioning also make themselves objectively felt in population development irrespective of our cognition or elucidation of the scale of their connections and degree of their effect on a population.

The logical structure of Karl Marx's great work *Capital*, and of other works of the founders of Marxism-Leninism, is an example of analysis of social and economic processes. Marx's method—ascent from the abstract to the concrete; analysis of the concrete relations and conditions of social life; analysis of production in definite social formations—underlies the investigation of all population problems and patterns.

In *Capital* Marx turned several times to an analysis of population. Having begun with several abstract propositions, he formulated the capitalist law of population in Chapter XXIII of Volume I as in substance an economic law. In Chapter XXV he again investigated the population problem under capitalism, but now in connection with colonialism. Problems of enormous significance for the analysis of population were also considered in Volumes II and III.

In *The German Ideology* Marx and Engels pointed out that "the first premise of all human history is, of course, the existence of living human individuals. Thus the first fact to be established is the physical organisation of these individuals and their consequent relation to the rest of nature."[1] They emphasised that any historical description must proceed from these natural foundations and their modifications by human activity in the course of history.

The evolutionary development of the organic world, including man, who is irrevocably linked with all nature around him, is an undisputed fact. Man is the highest stage in the chain of evolution of organic life on Earth, the result of the transition from the biological to the

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[1] Karl Marx, Frederick Engels. The German Ideology, *Collected Works*, Vol. 5, p. 31.

social. The primary basic cause of this transition was by no means the biological preconditions of becoming human. Marx, Engels, and Lenin showed that these biological preconditions could only take effect through labour. Labour, Engels stressed, "is the primary basic condition of all human existence, and this to such an extent that, in a sense, we have to say that Labour created man himself".[1]

Labour broadened primitive men's possibilities, encouraged their ever closer cohesion, gave rise to a need for speech, and led to development of the brain. Thus labour conditioned the appearance of man and the rise of human society from the horde of anthropoids.

The time when man originated has not yet been exactly fixed. The anthropological and archaeological finds of recent years have pushed it further and further back into the depths of time. The region where the process of anthropogenesis took place has also not been exactly established, but there are grounds for suggesting that it occurred in Africa, in an area where tropical forest gave way to steppe or savanna. Just such a transition of topography was needed to encourage the ancestors of man to come down from the trees to the ground and to adopt an erect gait, so freeing their front extremities. Only the recent anthropoids, Neanderthal man, who lived 60,000 to 25,000 years ago and were succeeded by men of modern type, have been relatively well studied.

Until recently the periodisation of prehistoric times accepted in Soviet science was that developed by the American scholar L. H. Morgan and adopted by Engels in his *Origin of the Family, Private Property and the State.* It divided the history of primitive society into a period of savagery and a period of barbarism, each of which was in turn divided into three subdivisions (lower, middle, and higher) on the basis of the features of human life, and the characteristic tools and utensils. Thus Morgan linked the transition from savagery to barbarism with the introduction of pottery.

In recent decades a new periodisation based on the great factual material accumulated by science (archaeological, ethnological, and anthropological) has been estab-

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[1] Frederick Engels. *Dialectics of Nature*, p. 279.

lished by which an era of the primitive horde is distinguished, and an epoch of the clan system and the tribal community, which are subdivided in turn into periods of the matriarchal and patriarchal clan systems. The boundary between the era of the primitive horde and the tribal epoch roughly coincides with the time of the formation of the modern type of man (*Homo sapiens*).

In the earliest period of human history—that of the differentiation of man from the world of animals—biological laws were decisive in determining the reproduction rate of populations.

We can judge the process of reproduction in primitive society, like other aspects of the life of primitive man, mainly from the data of ethnologists who have studied the life of tribes that are at low levels of development (Australian aborigines, Bushmen, certain American Indian tribes, and so on); valuable material for this has been provided by anthropological, palaeodemographic, and archaeological research based on the fossil remains of people of times directly related to the primordial state, their stone tools, drawings, and so on.

The extreme fragmentation and exclusiveness of primordial human formations, the wandering way of life, the feebleness of these little human groups in the face of forces of nature mysterious to them, all undoubtedly played an immense role in the life of man of that time, and in particular made it impossible for all people to pass through this stage of history in the same way. The original variability of the physical type itself was probably very different in hordes isolated from each other.

The development of the modern anthropological types of man was a very long, drawn-out process, and natural selection played a major role in it. It took thousands of years before natural selection lost its force.

Engels stressed the force of biological inertia dominating nascent human society for hundreds of thousands of years. This force of inertia also had its effect on the social aspect of primitive man's life.

The basis of primitive man's life was the gathering of edible plants, insects, etc., fishing, and hunting, modes of making use of the natural environment characteristic of the animal kingdom, but carried on with the

aid of fashioned tools, and usually in a group. The effectiveness of primitive man's efforts, however, was low and did not always yield a surplus product. The struggle to meet elementary needs, mainly the need for food, occupied the whole life of primitive man from earliest childhood. Hunting could give comparatively big returns, but the catching of game was irregular; and then the meat, especially in the tropics or in the hot season, did not keep long. A successful hunt was therefore usually followed by a brief feasting, which gave way to a long new period of semi-hungry existence. Primitive man's life in the temperate zone was very difficult, winter starvation carrying many off every year.

There is every ground for supposing that the death rate was very high in primordial times. Primitive man died from hunger and disease, perished from the attacks of wild beasts and in clashes between tribes. Infant mortality was particularly high. Considering the hard conditions of life, it is supposed, on the basis of the fossil remains found, that the average life span of Neanderthal man was less than twenty years. If we take it that population was then almost stable, that would give an average death rate of the order of fifty per thousand, not now found among any people on Earth. Mortality was probably the same, too, among the first men of modern type, so-called Cro-Magnon man.

The birth rate must have been quite high in primitive times, a little higher than the death rate postulated above (fifty per thousand), otherwise primitive man would have died out. High natality was maintained in those days chiefly by early, and in essence, complete involvement of all women in marital sexual relations, and in the absence of any kind of contraception whatsoever. At the same time fertility apparently did not reach the maximum. The early entry of females into marital sexual relations, immediately as a rule after the onset of puberty (sexual intercourse often began earlier), frequent pregnancies, and births in insanitary conditions, together with a hard life full of privations, led to the rapid ageing, and often early death, of women, so strongly limiting their possible child-bearing period. The regulating of marital sexual relations during the tribal-clan period, and the transition to a settled way of life, undoubtedly

contributed to an increase in fertility, though probably not a great one.

An important relative feature of the process of reproduction in primaeval times was its extreme unevenness in time and in separate tribes and regions of the world. In favourable conditions primitive tribes apparently began to increase in numbers through a reduction of mortality, and divided giving rise to new tribes that occupied newer and newer areas. The tribes that found themselves in unfavourable conditions, subjected to attack by stronger tribes, or suffering from natural calamities, shrank in numbers and not infrequently died out completely or perished.

Important stages in the development of the productive forces of primitive society were the mastering of fire and the transition to the beginnings of agriculture and cattle-rearing. The first gave primitive man a weapon for combating cold and wild beasts, the second laid the basis for his liberation from long full dependence on the powers of nature. Tribes passing to these more productive forms of economy gained new opportunities of increasing their numbers.

Population growth was a consequence of primitive society's triumph over the world of nature around it; as population grew man's power over nature was increased, and the need for food and shelter also increased. This growing need could only be satisfied to any extent by extending the scale of production and increasing the productivity of human labour, which were achieved at first by increasing the numbers of people involved in production. Then new sources for the growth of productivity developed, associated with the social division of labour.

In that era population problems were the most important concerns of social life, and their solving was directly linked with development of the productive forces. This direct connection was due to the correspondence of the relations of production to the character of the productive forces, and to the unity of the instruments of labour and labour power.

The patterns of population development in that era, seemingly, were an extremely small increment of population, in spite of the high birth rate (because of the

extremely high death rate), and a nomadic way of life over extensive areas. The population was small then because of the mode of winning the means of subsistence, i.e., the mode of production, which necessitated a broad territory for each separate member of the tribe.

The decisive law governing the population of the primitive communal formation was constant, extremely difficult, joint (collective) struggle of the whole able-bodied population for existence, in order to produce life, both their own by labour and new life by birth.

Development of the productive forces, and of private property, within the womb of the clan-tribal system, led to its dissolution. In the place of classless primitive society there came early class formations.

With the break-up of the clan-tribal system, slavery appeared almost everywhere and fostered the class stratification of society; but in the new conditions it did not always play the decisive role in the economics and class structure of the states of that epoch. Its role was greatest in the countries of the classical world, in the states of Ancient Greece and in Ancient Rome, where slaves constituted a significant part of the population and were the main productive force. In most other states, however, in particular those of the Ancient East (Egypt, Assyria and Babylon, India, China, etc.), the overwhelming majority of the population consisted of the juridically free members of rural communities; the number of slaves was comparatively small, and they belonged, as a rule, to the supreme ruler.

Slave-owners usually had no interest in natural reproduction of the slave population through marriage between slaves, because the expenses linked with it could not be recouped immediately; in addition, they frequently proved to be higher than the cost of a new slave on the market. It was also probably of no little importance that female slaves (especially young ones) became the concubines of their masters, or were considered potentially so. Hence the maintenance of separate quarters for male and female slaves limited intercourse between them.

Low natality among slaves was combined with very high mortality, undoubtedly exceeding that among the free population. With the exception of a small group (skilled craftsmen and house slaves), slaves were mainly

used on heavy work, in mines and quarries, on building roads, and so on. Gruelling toil under the supervision of pitiless overseers, meagre food and shelter, and cruel punishments quite quickly drove slaves to exhaustion and death; losses were made up by buying new slaves.

As regards the natural renewal of generations of the juridically free population, who paid taxes and fulfilled various labour obligations, reproduction preserved many features of the primitive communal epoch. It was characterised above all by high natality. Fertility rites, which arose almost everywhere in primitive society as the reaction to very high mortality, were substantiated and consolidated in early class societies in almost all the religious systems arising. Further regulation of marital sexual relations, in particular the transition to the monogamous family (combined in a number of countries with polygamy), and a certain improvement in the conditions of existence, all probably encouraged even a small rise in natality compared with the primitive communal era.

At the same time circumstances began to develop that lowered the birth rate. Among these were the permitting and even encouragement by certain religious systems (e.g., Buddhism) of celibacy or limitation of marriages (Hinduism's condemnation of second marriages for widows), the creation of large standing armies and the separation of a considerable part of the men from their families for long periods of military service. There also began to be a certain spread of the use of contraceptives. A marked fall in natality among well-to-do Roman citizens was recorded in historical works in the last centuries of the Roman Empire; to avert depopulation the Roman authorities were forced (in fact, for the first time in history) to resort to a planned population policy, to a policy of encouraging natality, and in particular to adopt a law imposing special taxes on bachelors and curtailing the civic rights of the childless.

In early class society there was a certain lowering of the previously very high mortality, which was mainly achieved through a reduction of death of starvation. The spread of cattle-raising and agriculture (including highly productive irrigated agriculture) consolidated the food base, and enabled a number of states even to create

reserves of corn. And although famines, caused by drought or other factors, still occurred, they began to be pushed into the background. Mass disease and wars came to the fore. Deaths from disease, above all from devastating epidemic diseases (plague, cholera, etc.) were increased by the growing concentration of people, especially in towns, and by the extension of contacts both within countries and between neighbouring countries and peoples. Deaths from war rose steeply; with the dissolution of the clan-tribal system wars acquired a massive and bitter character, and were waged almost continuously. The main aim of most of them was to conquer new territory, capture slaves and booty, and impose tribute on the population.

On the whole the average life span in this era was still comparatively short; in Greece and Rome, judging from the data available, it was around 25. The pace of population growth rose compared with the primitive communal era, but still remained low, varying from year to year by a few fractions of 1 per cent. The dynamics of the populations of separate countries and peoples was characterised by great unevenness; in comparatively quiet periods population began to grow, until epidemics, war, or famine brought growth to a halt.

The features of the reproduction of the free population in the slavery period also largely applied to the basic classes of the feudal period, the relations of production in which were characterised by full ownership of the main means of agricultural production, the land, by the ruling, feudal class, and by partial ownership of the rural labouring people themselves, whom the feudal lords could sell but could no longer, by law, deprive of life.

The classical form of feudal relations was found in Western Europe. In other parts of Europe, and especially in Asia, the feudal epoch was less marked and acquired a number of qualitative features.

The exploiting class of feudal lords, unlike slave-owners, had an interest in multiplying the number of serfs working for them through their natural increase. This was manifested first and foremost in lords' encouraging the marriage of serfs, sometimes forcibly marrying girls off immediately they had reached the established marriageable age. The serfs themselves, unlike slaves,

had the right to a personal household, and a certain though strongly curtailed freedom. Their personal husbandry independence grew markedly in connection with the transition from the system of labour rent (corvée) to that of rent in kind and money rent, which led to a property stratification of the peasantry itself. For well-to-do peasants they were stimuli to child-raising, which gave them a chance to consolidate their economic position in time through exploitation of the labour of their growing children. On the whole, however, the economic interest of the married serf couple in extending child-rearing should not be exaggerated. The high natality characteristic of this period, as before, was mainly determined by early marriage and the very high percentage of women contracting marriages, the absence of any means of contraception, and the extreme rarity of abortions, which were severely condemned by the Church.

The continuing small increase in the rate of population growth at this time compared with the epoch of slavery occurred through a certain lowering of mortality. The development of agricultural production gradually reduced the number of famines, or made them less disastrous. Wars, as before, were very frequent, but they usually no longer embraced such large regions and did not have such a devastating character, as, for example, the Roman wars against "barbarians" or the wars of the "great transmigration of nations". Among the causes of mortality epidemic diseases moved more and more to the foreground; the most terrible epidemic of the Middle Ages—the outbreak of bubonic plague (the Black Death) in the fourteenth century—carried off more than a quarter of the population of Europe. Certain measures were already being taken, it is true, against epidemics, mainly by instituting quarantine, but they did not yield effective results.

Two main factors of natural replacement of population were characteristic of pre-capitalist formations:

1. high natality owing to early marriage, which in essence embraced all females of child-bearing age; the absence of means of contraception and abortions; the general spread of fertility cults supported here and there by a population policy (a certain lowering of nuptiality among women was compensated by a gradual increase

in the average life span and of the child-bearing period);

2. high mortality owing to the low development of the productive forces, hard living conditions, famine, wars, and epidemics, mortality among slaves being particularly high; as the productive forces developed, especially agricultural production, the death rate gradually fell, which led (with the maintenance of high natality) to a rise in natural increase of the population.

Patterns specific to slave-owning society, in addition to those of natural replacement of the various strata of the population, were the migratory processes characteristic of this formation, and the settling of population. In certain periods of human history, in the primitive communal stage of its development, and under the slave-owning mode of production local absolute over-population occurred. It was this "pressure of population on the powers of production that drove the barbarians from the high plains of Asia to invade the Old World".[1]

In the ancient States, in Greece and Rome, to remain civilised they were forced to remain few. "The whole system of these States was founded on certain limits to the numbers of the population, which could not be surpassed without endangering the condition of antique civilisation itself."[2]

A way out of the situation created was, in particular, forced emigration, as a result of which Greek, Phoenician, and Roman colonies arose in various parts of the Mediterranean and the Black Sea; and veterans of the conquering legions were settled in the Roman provinces.

So the powers and relations of production of slave-owning society affected the patterns of population development (natural movement, structure, and the processes of settlement and migration characteristic of this formation).

Underlying the substance of the capitalist law of population is Marx's proposition that the accumulation of capital in bourgeois society leads to part of the able-bodied population inevitably being relatively surplus,

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[1] Karl Marx. Forced Emigration, *New York Daily Tribune*, 22.3.1853. Reprinted in: Karl Marx and Frederick Engels. *On Britain*, FLPH, Moscow, 1953, p. 374.

[2] *Ibid.*

being ejected from production and condemned to the misery of poverty and hunger.

Marx showed that, during the accumulation of capital, there was a growth of wealth at one pole and of poverty and lack of rights at the other; that the proletarian substratum of society increased as capital accumulated, relative surplus population grew, and the relative and absolute impoverishment of the working class increased.

Capital accumulation, by virtue of the very nature of the capitalist mode of production, does not allow wages to remain long at a more or less high level, and never makes it possible for them to reach the limit that would threaten the very existence of surplus value.

Many bourgeois economists conceive the variations in capital accumulation, which keep wages within certain limits to this day, as a variation in the number of wage workers offering their labour power.

They would have us believe that, with a slowing down of accumulation, there is accelerated growth of the working population, and with an acceleration of accumulation a slowing down of numerical growth of the working population. With that approach variations in wages are explained by variations in the numbers of the working population; and it is asserted that natural population growth allegedly leads to a lowering of wages, and vice versa. The authors of the "iron law of wages" completed this line of argument with an assurance that the lowering of wages brought with it an intensification of poverty and increased mortality among workers, which in turn led to reduction of the labour force and stimulated a new rise in the earnings of the remaining workers in production.

The apologetic essence of this "theory" is obvious. It no longer has any serious scientific foundation, since wages vary over a much shorter time interval than it takes to replace working generations.

As the organic composition of capital increases, its variable part grows relatively smaller.[1] This situation explains the relative decline in the demand for labour.

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[1] One must remember, however, that this does not mean a reduction in the absolute magnitude of variable capital.

Production increases but the demand for labour power falls relatively, since the more productive equipment needs relatively fewer workers.

A relative surplus working population is constantly being produced, in excess of the needs of capital for its self-expansion, in proportion to the pace and scale of capitalist accumulation.

As a result of the introduction of new machinery and of increasing the intensity of the labour of the workers engaged in production, not only do the workers directly displaced by the machines become redundant but also some of the rising generation of the working class, who are condemned in advance to unemployment.

The rise and the increasing size of the industrial reserve army in bourgeois society is also its economic law of population, inherent in the capitalist mode of production. This law reflects the actual position of wage labour in bourgeois society, in which it functions as an appendage of capital, and is an accessory of capital both within and outside the process of production, since the workers, even when they are engaged in satisfying their own personal needs, are thereby reproducing their capacity to work, which may be needed by a capitalist. The wage worker promotes capital accumulation by all his life activity.

Despite the assertions of certain of Marx's critics (e.g., Werner Sombart), he never spoke of the industrial reserve army of labour under capitalism as absolute overpopulation. Marx demonstrated that it was relative surplus population, that labour power was only surplus in bourgeois society in comparison with the demand capitalists had for it. Both Marx and Engels constantly emphasised that the powers of production were so developed in bourgeois society that, with more rational use, they could provide work and the means of subsistence for an ever growing population.

So the cause of the rise of a relative surplus population, and in particular of an industrial reserve army of labour, is growth of the organic composition of capital, which means the qualitative changes taking place in the structure of capital as it accumulates in the process of extended capitalist reproduction. That is the main fact, but not the sole one. The scale of the relative surplus

population also grows through the operation of several other factors.

Increased exploitation of employed workers leads to an ever greater amount of labour being squeezed out of the hired worker in the course of the working day, through raising of the intensity of work and lengthening of the working day. That enables capitalists to get along with fewer hands and so reduces demand for new labour power and increases unemployment. In this case, too, there is a saving of constant capital. The capitalist gets the chance to obtain the previous production results with a smaller amount of machinery.

Unemployment, in turn, the more it grows, enables capitalists to put more pressure on the employed workers, to intensify their work, to lengthen the working day, and to reduce wages.

A very essential factor influencing the growth of unemployment is wide use of female and child labour.

Relative surplus population is not only a product of capitalist production; it is also a lever of capitalist accumulation and an indispensable condition of the existence of capitalism. Without surplus population, Lenin said, capitalist industry itself could neither exist nor develop. Surplus population, "being an inevitable result of capitalist accumulation, is at the same time *an indispensable component part* of the capitalist machine".[1]

Relative surplus population makes itself especially felt in periods of economic crisis, when the recruiting of new workers for industry is reduced to the minimum and there is a considerable increase in the size of the industrial reserve army.

Marx's discovery of the economic law of population of capitalist society made it possible to explain the causes making for worsening of the position of the labouring masses.

Lenin emphasised, in his works devoted to the position of the working class and its struggle, that the order existing in the capitalist world always and inevitably inflicted countless sacrifices on the working class. Thousands upon thousands of people toiled all their lives

[1] V. I. Lenin. A Characterisation of Economic Romanticism, *Collected Works*, Vol. 2, p. 179.

to create wealth for others and died of starvation or chronic malnutrition and diseases brought on by abominable working conditions and terrible housing.

The life of the majority of workers in capitalist countries in the epoch of imperialism is one of constant fear of losing their jobs, increased exploitation, and a bitter struggle to live. "Insecurity of existence and unemployment," said Lenin, "the yoke of exploitation, and humiliation of every kind are becoming the lot of ever wider sections of the working population."[1]

Even from the data of official bourgeois statistics one can see the rise in the degree of exploitation of the workers in capitalist countries. The mass of surplus value appropriated by capitalists is increasing, while the rate of surplus value is rising.

The development of the capitalist mode of production also conditioned the specific character of the demographic processes. The transition from feudal relations to capitalist ones accelerated development of the productive forces, which in turn fostered a rapid growth of population. In the period of free competition capitalism population growth rates were very high.

In the last third of the nineteenth century there was a certain tendency for the birth rate to fall in the most economically developed capitalist countries. Sharpening of the contradictions of capitalism, intensification of the impoverishing of the broad masses, and World War I made this trend even more marked. The war at the same time led to an absolute fall in the population of several of the belligerent countries. Population growth rates began to fall.

For a great many countries the period preceding World War II was characterised by a replacement rate (net reproduction rate) less than unity (the level needed for simple reproduction).

In the economically backward countries the net reproduction rate exceeded unity, i.e., the replacement rate was more favourable; but in those countries, too, natality fell rapidly between the wars, first in the countries in which there were strong survivals of feudal relations of production.

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[1] V. I. Lenin. Draft Programme of the Russian Social-Democratic Labour Party, *Collected Works*, Vol. 6, p. 28.

Since World War II the features characterising reproduction in capitalist countries have been the following: the usual post-bellum compensatory rise of natality; the return of the most developed countries to the pre-war contracted reproduction; a tendency for a number of countries of the second type of reproduction to draw closer to the intermediate group, and of some of the countries in the latter to draw closer to those with contracted reproduction; a lowering of mortality in a number of countries of the second type with a stable birth rate.

From our analysis of the types of reproduction characteristic of the capitalist world, we can conclude that the importance of countries in which natural increase has risen in connection with a falling death rate is very great; this is due primarily to the character of the development of the productive forces and the level of development of industry.

Under capitalism growth of the productive forces undoubtedly necessitates a reduction of population and elimination of the surplus part, which may be brought about by hunger or epidemics. Raising of the productive power of a given quantity of labour, and lowering of the ratio of variable capital to constant, lead to the creation of relative surplus population. A surplus of capital with a surplus of population affects, through a mass of intermediary steps, the decision of married couples to have a second or a third child. Modern industry's high demands as regards workers encourage parents to seek to give their children better education and vocational or trade training so as to be confident of their adaptation and chances of holding out in the battle for jobs.

The contradictory capitalist forms of production give rise to contradictory phenomena in the world capitalist system such that, in some countries in which there is a surplus of capital, natality falls and emigration increases, while the population is growing in less developed countries at rates not previously observed, and is threatening to disturb the spontaneously formed proportions of the world capitalist system. This explains the exceptional interest of bourgeois ideologists in the problem of the ratio of population and industry in economically less developed countries, and their endeavours to alter this

ratio by lowering the birth rate. "A development of productive forces which would diminish the absolute number of labourers, i.e., enable the entire nation to accomplish its total production in a shorter time span, would cause a revolution, because it would put the bulk of the population out of the running."[1]

The workers' lack of means of subsistence, the absence of confidence in the morrow connected with the growth of mass unemployment, the ups and downs of the economic situation, and other factors caused by the very nature of the capitalist system lead to a reduction of natality and to a fall in the number of marriages, an increase in the number of divorces, and a decrease in the number of large families, which even bourgeois demographers are being more and more forced to admit.

The worsening position of the working people in the era of imperialism leads to sharpening of the class struggle. The class battles of the proletariat for higher wages, against the high cost of living, and against redundancy take on an increasingly more clearly marked political character, and always lead to the realisation that there is no other way out of the situation for it than the overthrow of capitalism and the building of socialist society.

Lenin pointed out that putting the population problem into its social and historical context meant studying "the law of population of each historical system of economy separately, and studying its connection and interrelation with the given system".[2] When population is analysed in its interconnection with the social and economic system, it must be taken as a socio-economic category. While a considerable part of the population is the main productive force of society, the whole population, including this part, is its consumer force.

Population's function as the consumer force of society includes the existence of its opposite function as the main productive force. There is a transition during its evolution from one opposite to the other. All the elements of the main productive force are also elements of the consumer force. This duality of function is separated

[1] Karl Marx. *Capital*, Vol. III, Progress Publishers, Moscow, 1974, p. 263.

[2] V. I. Lenin. A Characterisation of Economic Romanticism, *Collected Works*, Vol. 2, p. 177.

in time for each of the elements. Members of the older age groups of the non-working child population gradually grow into the group of working age. This is at once a process of the transition of persons belonging solely to the consumer force of society to the group of persons, who belong simultaneously to the main productive force of society and to the consumer force. A similar transition, of opposite character, is observed with the passing of the working population into the older, non-working group.

Reproduction of the population as the main productive and consumer forces of society is going on constantly, everywhere. In the course of social development there is a contradiction between these two aspects of population as a socio-economic category.

In addition, population as a socio-economic category is a unity of the main productive and consumer forces of society, and this unity has its quantitative aspect as well as a qualitative side. The quantitative aspect is seen primarily, on the one hand, in the form of a certain ratio between the total population, the employed population, and the able-bodied population, etc., and on the other hand, as a certain ratio between the magnitude of production and consumption, between accumulation and consumption in the national income, and so on.

What underlies all these ratios in the process of socialist reproduction?

Let us begin with accumulation, which is the basis for growth of productive assets. The form in which producers are combined with the means of production, i.e., the form of ownership, is the basis of the whole ensemble of production relations. Underlying the relations of production in socialist society is common ownership of the means of production.

Common ownership of the means of production presupposes the possibility of full employment.[1]

[1] By full employment here is meant quantitative and qualitative correspondence between the objective general demand for jobs and its satisfaction. In that connection we must also note that it is necessary to distinguish such concepts as the degree and level of employment since, in fact, there are jobs in the socialist economy with a short working day or a reduced working week.

As regards the concept of level of employment, this is a quantity that depends on many factors, in particular on the level of

Continuous technical advance, which is a necessary element in the evolution of the socialist economic process, presupposes a change in the numbers and composition of the labour force occupied in one branch of the economy or another, or in an enterprise. The planned character of the socialist economy provides opportunities for a certain control of the processes of reducing or increasing the numbers of employed by regulating accumulation and extending production, which ultimately ensures full employment of the able-bodied population. "In contrast to capitalism," says the Programme of the Soviet Communist Party adopted in 1961, "the planned socialist system of economy combines accelerated technical progress with the full employment of all able-bodied citizens."[1]

Underlying full employment is the quantitative and qualitative correspondence between the main productive force and the means of production, a correspondence expressed, in particular, in the complex of the distribution of jobs by level of assets per worker characteristic of the economy as a whole, and of separate industries, production units, etc. As socialist production develops there is a rise in the average level of assets per worker, so that the distribution of jobs may alter or remain unchanged. In a given case the essential thing is not the change in this distribution but in socialist society's opportunities of regulating it on the basis of social ownership of the means of production. The problem of controlling the distribution of jobs by assets per worker is an integral part of the problem of the efficiency of socialist social production.

Socialist society is striving not only for quantitatively full employment of the working population but also to obtain the maximum general economic effect. From the angle of the use of manpower, a greater or less economic effect is linked with the solution of such problems as the

the productivity of social labour, the ratio of extensive and intensive types of economic growth, the dynamics of manpower reserves, etc. In addition, increase in the leisure of the members of socialist society, which is achieved by going over to a lower level of employment, is a most important indicator of a rise in living standards.

[1] *The Road to Communism*, Progress Publishers, Moscow, 1962, pp. 513-14.

rational distribution of labour between social production, housework, and personal holdings and allotments, between the productive and the non-productive sphere, and between branches of production; and also the problems of deciding the length of the working day and the use of working time, growth of labour productivity, and so on.

Evaluation of the efficiency of social production presupposes commensuration of the outlays and the results. In socialist society that is done through operation of the law of value. Manpower resources are also involved in this general process of commensurating various resources and products by degree of economic efficiency. Labour is the sole source of the creation of value; but for any object an increase of resources (within certain limits) can be brought about through any of their forms, including manpower. Consequently there is an objective need for a comparative evaluation of manpower resources, a need that is also manifested in determination of their rational distribution and in evaluation of their size in industries with a comparatively long time lag.

In the general commensuration of resources and products by degree of economic efficiency, manpower resources are differentiated by the following points:

1. certain specific features, consisting above all in the constant need to ensure full employment;

2. their reproduction being mediated through reproduction of the population, which in turn is determined by a broad complex of socio-economic factors (which explains at bottom the complexity of the problem);

3. the objective existence of a comparatively long period for their natural reproduction;

4. the possibility, parallel with full employment, of regulating the length of the working year, i.e., the level of employment;

5. their scale at any moment of time having little relation to the economic activity of society that took place quite a long time before the given moment.

There is a maximum correspondence between economic effect and rational levels of the use of resources of all types. For manpower this level is rational employment, which is the level of employment (in space and time) corresponding to the maximum economic effect.

Determining of rational employment is a complex problem which presupposes simultaneous consideration of many factors and solution of an optimal task on a macro-economic scale. It will therefore still be a matter of full employment. In connection with the need to maintain a certain ratio between the amount of manpower and of productive assets, a change in the former must go hand in hand with a corresponding change in the latter.

In order to maintain full employment (other things being equal), the volume of productive assets must increase in proportion to the increase in jobs in the productive sphere.

A progressive change in the form of distribution of assets per worker necessitates an ever greater increase in productive assets.

The necessary changes in the magnitude of productive assets, which is a function of accumulation, must be preceded at a certain time interval by definite amounts of productive accumulation.

Population, consequently, being the basic productive force of the society for which full employment is to be provided, requires a certain amount of productive accumulation in movement.

In addition, being the consumer, population presents a demand for the fullest possible satisfaction of its needs. The consumption fund of the national income constitutes the material basis for reproducing the employed part of the population and the members of their families. Its size in movement is determined by a host of factors, one of which is the dynamics of the total population (its structure still being left out of account). An objective estimate of the adequacy of the magnitude of per capita consumption at any moment of development of the optimal economic process is made simultaneously from several angles. In particular it must satisfy the requirements of providing continuous maximum satisfaction of the needs of the members of socialist society, and of ensuring the necessary rate of reproduction of the population, i.e., reproduction of the basic productive force of society. The material basis of the action of the economic process on the qualitative determination of labour resources is the fund for personal consumption of the workers in the sphere of material production, the fund

for science, art, culture, and health services, the fund for housing, services, and public amenities, and the social security fund.

As regards estimates of the dynamics of the size of the consumption fund, it must be noted that its size has a lower limit in connection with the need to provide for growth of per capita consumption.

Thus the population, as the main productive and consumer force of socialist society, is one of the factors determining the ratio of accumulation and consumption in the national income. Taking an estimate of the effect of the demographic factor alone as our point of departure (which, together with other factors, determines the magnitude of the lower limits of the consumption fund at any moment of development), we can determine the possible upper limit of the accumulation fund, and consequently the rate of accumulation.

We have calculated these quantities for certain years and compared them with the actual general rates of accumulation in the USSR (see Table 1). It will be seen that the actual general rate of accumulation for 1960-1970 was quite close to its upper limit.

Table 1

The Demographic Upper Limit of the General Rate of Accumulation and Actual Rates (in percentages)

	General Rate of Accumulation								
	1960	1962	1963	1964	1965	1966	1967	1968	1970
Estimated upper level	31.8	33.2	29.4	30.7	31.8	31.7	32.8	32.9	34.6
Actual level	26.8	27.7	25.7	27.4	26.1	26.5	26.8	27.0	29.4
Difference	5.0	5.5	3.7	3.3	5.7	5.2	6.0	5.9	5.2

As for determining the lower limit for the general rate of accumulation, based on the requirements of the demographic factor, the task, it must be noted, is much more complicated. Its solution is directly linked with such problems as determination of the ratio between the productive and non-productive spheres in the total labour force, and of the funds for productive and non-productive

accumulation, allowing for the current time lag between accumulation and the increment to the funds, and so on.

The demographic limit of a fall in the rate of productive accumulation, the objectively existing consequence of the need for steady growth in the scale of per capita national income, is a comparatively small quantity, of the order of four or five per cent, which is due, to some extent, to the fall in the growth rate of the USSR's population in recent years.

The analysis above points to a close link between economic and demographic processes, and determination of the latter by socio-economic phenomena; in that sense, demographic phenomena are a socio-economic category.

In functioning as the main productive force population necessitates a certain amount of accumulation in connection with the need to maintain constant full employment under socialism, and consequently also to maintain the proportion of accumulation in the national income. As the main consumer of the whole end product of society, the population presents a requirement, in accordance with the basic economic law, for ever fuller satisfaction of its wants.

The magnitudes of accumulation and consumption, which in sum constitute the size of the national income (which is determined at any moment of the development of the economy, and is consequently limited) are in constant contradiction. The most general form of the resolution of this contradiction is the objective establishment and constant maintenance of a rational ratio of accumulation and consumption in the national income that will ensure reproduction of rational employment of the whole able-bodied population at a level of consumption meeting the requirements of the basic economic law of socialism.

It is in fact in the resolution of this contradiction that the essence of the basic economic law of population under socialism consists, expressing the real and most necessary ratio between society's main productive force and the whole population as a consumer force.

The requirement of a certain ratio of accumulation and consumption, which is the central proportion of socialist extended reproduction, is directly linked with

the law of the balanced (proportional) development of the economy. Under socialism these basic proportions and ratios are regularly taken into account in national economic plans.

Continuity of social production and high development rates presuppose continuous reproduction of the main productive force of society, i.e., manpower.

If in analysing the growth sources of consumption and production we abstract ourselves from the non-productive sphere and social consumption funds, then the necessary product consists in fact of two parts: (a) that needed to reproduce the labour power of the producers; and (b) that needed to maintain and raise children. Their ratio in the value of the necessary product is differentiated according to the different groups of elements of the basic productive force of society. For the economy as a whole this ratio has a quite definite level and characterises the ratio in value terms of the magnitudes of the consumption of the producers and of their children. Given identical average conditions of consumption per producer and per element of the child part of the non-working population, this ratio may also vary for the economy as a whole through changes in the quantitative ratio between the number of direct producers and the size of the child part of the population, and vice versa. It is difficult to draw a hard and fast line between these two parts, but one objectively exists.

Under socialism the necessary product consists of the two main parts considered here. For any moment in the development of the socialist economic process, its size is determined by a complex of factors (the level of development of the productive forces attained; the level of the productivity of social labour, etc.), and is consequently limited. For any moment of time, therefore, the part of the product necessary in the given conditions to maintain and raise children is also limited, and this limitation affects the birth rate or the reproduction rate of the population. As socialist society develops the minimum level of consumption (in comparable prices) needed to reproduce the elements of the child part of the population, it should be noted, can only rise. From the angle of the development of the socialist economic process this part of the necessary product can be looked upon,

as regards its economic content, as "accumulation" of the basic productive force of society.

Many factors determine the actual rational ratio between the two parts of the necessary product, including the relation between the maximum possible consumption fund and the total population in movement, the ratio of the main parts of the population from the aspect of their relation to the process of production, the level of per capita consumption in the preceding period of time, and so on. Thus the moulding of this correlation is directly linked with a certain rational ratio of accumulation and consumption in the national income that underlies the economic laws of population.

Chapter 2

POPULATION REPRODUCTION

L. Y. Darsky, Cand. Sc. (Econ.)

As the object of study of demography population is not a static aggregate but a plurality of objects that are in continuous movement. Demographers distinguish three types of population movement reflecting different aspects of its process of change. First of all, social movement is distinguished, or as it is usually called, social mobility, which embraces all shifting of people from one social group to another. This form of movement alters the social structure of a population, and both demographers and sociologists are interested in studying it.

Mechanical movement of population or, as it is generally called, migration, is any territorial shifting of people, either permanent, linked with a change of domicile, or temporary. Migration alters the territorial distribution of population and determines the settlement of people. Its study falls at the point where demography and population geography overlap.

Natural population movement includes those processes in a population that are the direct consequence of man's biological nature and proper to a human population as a biological entity. The facts of natural movement include deaths, births, and the formation and dissolution of marital unions. Underlying each of them are the special features of man as a biological species (*Homo sapiens*);

but in human society they become social facts. Though not severed from their biological basis, the facts of natural population movement are so closely linked with a host of causal dependencies with other facts of social life that natality, nuptiality, and mortality cannot be looked upon as anything other than social processes. The replacement of one generation by another through birth and death, and multiplication through the creation of marital unions are peculiar to man as a biological creature; but that is only the natural basis of the reproduction of a human population. The principal laws of this process are social in character, from which follows another very important consequence, namely, that the most important characteristic of a human being is his or her age, a biological parameter of paramount social importance.

Demography considers the reproduction of population from two aspects: (a) reproduction in the narrow sense of the term, when only the natural movement of the population is examined; and (b) reproduction in the broad sense, when the whole concatenation of the processes of population movement are considered. With this last interpretation in mind demography is called the science of the reproduction of population. Occasionally its subject is restricted to reproduction in the narrow sense, bearing in mind its traditional and most developed fields.

In studying reproduction in the narrow sense we have to abstract it from all forms of population movement except natural ones. For that purpose two artificial limitations are imposed. The first is that a population is regarded as a single, socially undifferentiated aggregate with three structural characteristics: sex, age, and family status. This approach is necessary as the initial stage of study; later, in considering mathematical models of reproduction, we shall see that the most developed of them do not require these limitations, and though built as an instrument for studying reproduction in the narrow sense, they prove adaptable to study of all its aspects.

The second limitation, although just as artificial, but less essential, is the hypothesis of a "closed" population, i.e., one in which there is no migration beyond the limits of the aggregate being investigated. The significance of this second limitation depends on what popula-

tion we are considering. If our argument relates to the population of an individual town or, say, the aggregate of the whole urban population of some area, then the artificiality of the characteristics adopted must always be kept in mind; but if we are considering the population of a country as a whole, then the hypothesis of a "closed" population comes very close to reality (for most countries). The limitations that it imposes on the indices can be ignored.

When these limitations are used the reproduction process of a population becomes quite simplified, so that it can be examined by means of relatively simple mathematical methods, relying on demographic statistics. For such a study there are two approaches or methods of investigation, each of which has its positive and negative aspects.

The first method consists in tracing the demographic fate of a definite aggregate of people in time, and in investigating the demographic processes taking place within it. At first glance this approach, known as the cohort method, is quite natural and methodologically simple. Say the mortality of the generation born in 1900 is being investigated. Today, in 1977, people who were born in 1900 are 77 years old. One can determine how many of them survived to a certain age, and also what the probability of dying at a certain age was for this generation. It is also possible to investigate what causes they died from, and so on. And in exactly the same way their nuptiality, divorce, and natality could be studied.

After studying the demographic facts in this way of all generations now living, we would know the demographic past of the population and obtain the needed historical perspective. But that is not enough to get a complete picture of the process of reproduction at present, or to determine its development in the future.

In however much detail we studied the mortality of the generation of 1900, we could not determine, say, the average life span of that generation, as that would require tracing its life to the very end. We could not obtain this characteristic earlier than the year 2000 or 2020; and then it would only present historical interest and could not help us either in our study of the present or in forecasting,

any more than the most detailed data on the mortality of the generation of 1876 can help us now.

Matters are exactly the same with study of nuptiality and natality. While all the marriages and births of the generation of 1900 are now in the past, and we have all the characteristics needed, they can only help us a little in studying nuptiality and fertility in today's population when their children and grandchildren are marrying and having children.

Another purely practical complication of using the cohort technique, it must be noted, is that methods of investigating reproduction are constantly being improved and call for more and more detailed demographic statistics. The improvement of statistical practice as a rule lags behind theory, and we almost never have access to the necessary information on the past.

The second method of investigating reproduction is based on study of the intensity of demographic processes at a given moment of time, say, the mortality of the population in 1959. In that year children born in 1958 died, and old people born in 1880. Years of studying mortality have shown that its level is determined mainly by living conditions at the moment rather than by the characteristics of the population.

Of course, the history of a generation must be taken into account. Thus the death rate of persons aged 59 in 1959 was determined not only by living conditions in that year but also by the fact that the health of people born in 1900 was undermined by the two world wars that they endured.

Certain methods of mathematical data processing enable summary characteristics to be obtained from data on the intensity of the processes in various generations at one and the same moment of time. Thus we can say that the average life span of the population of the USSR in 1958-59 was 69 years. That figure, quite understandably, did not apply to any one concrete generation living in 1959 but characterised a hypothetical generation that would, in the course of its life, have had the same mortality for each age as was characteristic of persons of that age in that year. Characteristics of nuptiality, divorce, and natality can similarly be obtained for the hypothetical generation, but one must always remember

their artificiality and be extremely careful in interpreting them. There is always the danger of their being wrongly interpreted and more information being sought from them than they can provide.

A complete picture of reproduction can only be obtained by combining these two methods of research; but such an approach is seldom possible because of the poverty of the statistical information.

The function of reproduction lies with people of adult age physiologically capable of bearing children. The moment of physiological maturity is reached at a different age in different people. In demography the conventional lower limit of productive age is taken as fifteen for females and usually as seventeen or eighteen for males. These limits, like any age limits, are of course arbitrary; but they are quite close to the average age of reaching physiological maturity. From this age people marry and reproduce offspring. Children are born, as a rule, in wedlock and only in rare cases are they the product of chance intercourse.

Demography tends to consider marriage as a stable union in which a man and a woman mutually recognise each other as man and wife, i.e., adopt the concept of *de facto* or common law marriage. The concepts of illegitimate birth therefore do not coincide from the demographic angle and the juridical point of view, and diverge to varying degrees in different countries. Demography makes broad use, of course, of the statistics on the conclusion and dissolution of juridical marriages, but when the movement of *de facto* marriages differs essentially from that of legal marriages (as happens, for example, in Latin America) it tries as far as possible to obtain information on the actual state of affairs.

The proportion of men and women not marrying at all is quite low and normally varies between 3-5 per cent to 10-12 per cent in different generations. In exceptional circumstances it may drop to 1.0 or 1.5 per cent or rise to 18 or 20 per cent.

Such an exceptional situation can arise either because part of the population is prevented for one reason or another from marrying (in Mongolia, for example, Lamaism used to be very common), or because of a marked disproportion of the sexes among the marriageable gener-

ations. Sex disproportion can arise either as the result of marked migration, when men predominate among the emigrants, as happened in Ireland, or as the result of considerable war losses. In some cases a steep drop in nuptiality can also occur without any disproportion of the sexes, as a consequence of economic crisis, as happened in Western Europe in 1929-32.

In the USSR nuptiality is at the normal level. Thus, according to selected data for 1949-59 published in *Vestnik statistiki* (No. 8, 1967), around 8 per cent of women had not married by 50; but this average figure concealed a considerable territorial differentiation. Whereas the proportion not marrying by 50 was 3.7 in rural areas in Central Asia and Transcaucasia, it was 21.7 per cent in rural areas in the Ukraine and the Baltic republics. The decline in nuptiality among the women of these latter areas occurred because the sex disproportion that developed as a consequence of heavy war casualties was further aggravated by an exodus of young men from the country into the towns. In the urban areas of these republics nuptiality was very high—only 3.7 per cent of women not being married by 50.

Considering that illegitimate births are relatively rare, it is understandable that women who do not marry cannot contribute fully to reproduction of the population. The rest, i.e., those who marry, are also involved in varying degrees. The age of marrying is above all of great importance; the later a woman marries, naturally, the fewer children she has (other conditions being equal). Thus a woman of maximum fertility, not restricted in any way, who marries when she reaches sexual maturity, will have ten children on an average; if she marries at 20 (given the same conditions) she will have 8.4 babies, but 6.2 at 25, and only 4.2 at 30. This index, which is very important for studying reproduction, is known as the productivity of marriage.

The age of marrying also affects fertility in a significant way when it is at a low level, i.e., in cases when families consciously try to limit their offspring to a small number of children. Thus, in France in 1931, i.e., in a period of very low fertility, the productivity of the marriages concluded by women at 20 was 2.5, 1.9 at 25, and 1.4 at 30.

In the USSR, according to the selected data for 1949-59 already referred to, the productivity of marriages was as shown in Table 2.

Table 2

Productivity of Marriages in the USSR (1949-59)

Age of marrying	15-19	20-24	25-29	30-34
Productivity of marriages	5.2	3.6	2.3	1.7

It is also important, as regards reproduction, that not everyone marrying remains married to the end of the fertile age, i.e., to around 50. Some marriages break up through death of one of the partners or because of divorce, so that the indices of productivity given above relate not to all marriages but only to those that last to the end of fertility. In addition, not all women reaching fertile age survive to marriage, although, with present-day low mortality, the effect of this factor is not great; but one cannot ignore it. Taking the probability of dissolution of marriage into account, and knowing the age distribution of the women marrying, we can calculate the mean net productivity of marriages. According to the above selected data, each woman surviving to fifteen gave birth to 2.77 children on average per first marriage. When one takes into account that the chance of girls reaching 15 is 94 per 100 births,[1] then, given the current indices of mortality, nuptiality, stability of marriage, and productivity, the expected offspring of 100 newborn girls was 260 children on average. Since the number of girls born among these would be around 48 per cent, every 100 girls of the first generation would have 128 girls in the second generation. In addition a certain number of children would be born outside marriage and to second marriages. Their contribution to reproduction must also be allowed for, but it is not significant.

The replacement rate of generations thus obtained is known as the net reproduction rate, and is a very

[1] See *Tablitsy smertnosti i srednei prodolzhitelnosti zhizni naseleniya SSSR 1958-1959 gg* (Mortality and Life Tables of the Population of the USSR in 1958-1959), Moscow, 1962.

important index of demographic development (see Table 3). It is usually arrived at in a simpler way, in general without considering the processes of the formation and dissolution of marriages. The simplified index, in which the family structure of the population existing at a given moment is allowed for but not the intensity of the processes bringing it about, usually gives quite a good approximation.

If the calculations relate to a period following essential shifts in nuptiality, they can, it is true, be misleading, and if the index is close to unity, which usually means a level of simple reproduction, one must be very cautious in drawing conclusions about the contracted or extended character of reproduction.

Such in brief is the general picture of reproduction. We must add that human generations succeed each other with a relatively constant rhythm. The average age of women at the birth of the mean daughter, or as demographers say, the length of a female generation, varies between 27 and 29, while the length of the male generation is two or three years longer. This constancy in the average difference between the ages of parents and children deserves close attention. Although the rate at which one generation succeeds another is limited to a very narrow range, the intensity of reproduction of a population can vary within very wide limits. In theory one can imagine a population growing at a colossal pace. Thus, with high and early nuptiality, low mortality, and an absence of conscious birth control, the net reproduction rate could reach 4.0. In real life such a rate does not exist, but in some countries it is very high; in Costa Rica, for example, it was 2.65 in 1964, in Guadeloupe in 1961-63 it was 2.63.

In certain combinations of the parameters of mortality, nuptiality, and marriage productivity, a net rate much below unity can be expected.

Given a description of the reproduction process in the form of a mathematical model, or in numerical form, the question then naturally arises of describing and explaining the dynamics of the process in time, and of what factors govern it.

The principal processes of reproduction began to feel the influence of a social organism the moment it was born. One of the first forms of social organisation, "collec-

Table 3

Net Reproduction Rates for Selected Countries

Country	Years	Net reproduction rate
1	2	3
USSR	1938-9	1.498
	1958-9	1.262
	1961-2	1.206
	1962-3	1.175
	1963-4	1.135
	1964-5	1.134
	1965-6	1.134
	1966-7	1.128
	1967-8	1.114
	1968-9	1.110
	1972-3	1.128
Bulgaria	1956-7	1.012
	1968	1.060
Czechoslovakia	1937	0.755
	1969	0.950
Hungary	1940-1	0.972
	1968	0.950
Poland	1934	1.114
	1968	1.040
Yugoslavia	1967	1.110
Australia	1939	0.995
	1969	1.370
Austria	1937	0.720
	1970	1.070
Belgium	1939	0.859
	1968	1.090
Denmark	1939	0.940
	1969	0.940
England and Wales	1939	0.822
	1969	1.160
Federal Germany	1947	0.899
	1969	1.030
Finland	1939	1.040
	1969	0.860
France	1938	0.910
	1968	1.220
Italy	1935-7	1.131
	1967	1.140
Netherlands	1939	1.168
	1968	1.290
Norway	1939	0.849
	1969	1.280
Sweden	1931	0.820
	1970	0.920

tive self-defence" against animals and the forces of nature, was at the same time the first attempt to combat mortality. But the first demographic process to acquire a really social character was nuptiality. The social regulating of nuptiality was a necessary step in the development of society, and although the forms of marriage and the family evolved together with society, at each stage of its development society has striven to limit the sexual intercourse of its members and consequently the reproduction of its population solely to the socially sanctioned form of marriage. This end was served both by the oldest taboos and the latest systems of moral and legal standards.

Society has striven, by means of state and religious incentives and stimuli, but mainly by various moral and economic ones, to control the marriage rate and the age of marrying for its own purposes. In a period when mortality was high, high and early nuptiality was needed for reproduction of the population. All ancient religious systems and laws therefore encouraged early nuptiality, and sterility was considered grounds for divorce. Religious systems arising later were already, at the beginning of our era, approaching the problem of marriage much less one-sidedly. Christianity and Buddhism instituted monasticism and celibacy, which considerably reduced nuptiality among certain populations. At the same time, Islam, evolving in different surroundings, stimulated nuptiality.

In the age of capitalism economic factors became the main regulator of nuptiality. The subsistence economy under feudalism, and the communal form of land use among many peoples stimulated early nuptiality, while private property in the land and a commodity economy, on the contrary, could also lower it and stimulate postponement of marriage. Marriage was converted in many cases into a simple business deal. Only in recent decades in Northern and Western Europe have marriages become earlier and nuptiality itself increased.

Mortality began to be brought under social regulation much later. Only in the eighteenth century did man acquire the means enabling him to reduce it from the level that had for long been considered natural.

In E. Rosset's view the average life span was 22 at the beginning of our era, and 26.5 in the Middle Ages, rising

to 30 in more favourable periods. At the end of the eighteenth century a level of 30 was established. Only the mass prophylactic measures of the past 150 years made it possible to raise the average life span to 70 or 72. But that level has only been attained in industrially developed countries.

As regards the social factors regulating natality, the mechanism whereby social life and social consciousness affect it is not wholly clear. It is only known that measures for preventing conception and interrupting pregnancy were known in antiquity, yet at the present time, even in the most highly developed countries, around half the married couples do not resort even to more modern methods. One might suppose that the limited spread of attempts at family birth control in most populations up to the end of the last century was due to a conscious striving for a large family, and that the spread of the small family in our day in most economically developed countries must be linked with changes in social life and social consciousness, while the development of modern contraceptives is only the consequence of the development of a need for them. In industrially developed capitalist and socialist countries a new type of reproduction has taken shape, based on low mortality, high and early nuptiality, and low productivity of marriages. Developing countries have still not reached this stage of demographic development; and in them the lowering of mortality is still combined with high, early nuptiality and high productivity.

A population's pattern of reproduction is governed by social and economic factors, i.e., ultimately by the aggregate of the productive forces and relations of production. But demographic behaviour as regards nuptiality and natality is very conservative and largely depends on the views and traditions of peoples. The views and traditions themselves often retain their force when the social and economic conditions that engendered them have already altered.

Change of the pattern of reproduction, which, as we have said, is the consequence of social changes, itself leads to consequences of a social character, the first of which is a change in the structure of the population and of the family.

The change in the sex and age composition of populations consists in the proportion of persons of junior ages being considerably reduced and that of old people rising. Thus, in Great Britain, the proportion of children under 15 fell between 1851 and 1951 from 35.5 per cent to 22.5 per cent. In Japan, where the transition to the new type of reproduction only began intensively after World War II, the proportion of persons under 15 fell from 35.4 per cent to 26.3 per cent in just the period from 1950 to 1964. In the USSR ageing of the population is also taking place. In 1970 children under 16 constituted 30.9 per cent of the total population as against 40.4 per cent in 1897.

The changes in age structure that have come to be called ageing of the population bring about the most varied consequences for the life of society. In the field of public health it leads to a need for a certain reorientation in the training of medical staff. Along with a need for paediatricians there develops a need to increase the number of specialists in the diseases of old people. The age structure of the population also sets its impress on the distribution of social funds, on the structure of manpower resources, and on many other spheres of social life.

Changes in the structure of the family bring about special consequences. The natural isolation of the young people of small families poses the problem of their living separately from a family of children, a problem that scarcely exists in large families in which there are always babies and adolescents. The small family, which in itself is to some extent a consequence of the striving of women for active involvement in social and public life, raises many problems in this field. The small family does not liberate women from heavy expenditure of time and labour on housework, while full employment in social production overburdens them, so that complicated situations arise. Thus some women, for the sake of full participation in social and public life, and work in their chosen profession, limit their families to two children or one, which is insufficient for normal reproduction of the population; while others, on the contrary, having three or four children, limit their own life to the family circle alone. Rational distribution of the labour of women

inside and outside the family is therefore another acute problem linked with normal reproduction of the population.

In general the combining of the family's and society's interests in problems of the reproduction of posterity is very important. Every family has the undisputed right to decide itself how many children to have; but society is not by any means disinterested, and its future depends on what decisions families take. Only far-reaching knowledge of the patterns of reproduction provides an opportunity of working out the rational demographic policy needed to maintain unity of the interests of the family and society.

The situation in the process of reproduction described above is a common one for modern demography. Representation of the main demographic processes in the form of a relatively simple models that enable one to answer how the population would be reproduced if these processes took place in such and such a way resolves one of the principal problems of demography, that of obtaining summary synthetic indices from the outwardly separate and unconnected data of demographic statistics. The process of reproduction itself, however, is much more complex than the models describing it, either in their classical form or in their modifications. Nothing quite happens in life as it does in models. The farm population of the USSR is declining, although its net rate is above unity; and conversely the population of the biggest cities, with (according to the models) contracting reproduction, is growing at very high rates.

The numbers of the intelligentsia, who are distinguished by the lowest fertility, are growing very fast, while the numbers of the peasantry, who have the highest fertility, are, on the contrary, declining. The number of second marriages, which are ignored in the demographic models, is growing, and so on. All these processes are readily explicable, generally speaking, from the knowledge already at the disposal of modern demography, but they all lie outside the model itself. The situation raises quite legitimate questions of why the model does not reflect life, of what in fact it does reflect, and what is the use of it if it does not reflect real processes and if all the forecasts made with it lack validity.

Some of these contradictions arise just because we often do not use a model as it was intended, forgetting its built-in limitations. No large town or social group, for example, can be represented as a closed population, and it is senseless to use indices like the net rate for them. Unfortunately the available model for an open population is very imperfect; it allows us to obtain characteristics of reproduction only for populations taken separately and takes into account only the balance of migration, considering it as a function of population.

Such an approach is very primitive, and at the same time does not make it possible to obtain characteristics for interconnected populations, i.e., does not permit us to study the reproduction of a population when it is considered as a socially or territorially differentiated aggregate. Solution of that problem, it is true, is relatively simple if, in building the model, we go over from the traditional analytical forms to the language of matrices; but then the amount of information required increases greatly, which transforms the model, given the present state of demographic statistics, into a purely theoretical construction.

There are also problems, however, in present-day models of reproduction, and in the very ideas of demographers on the process, that do not lend themselves even to such a purely theoretical solution. The first is the problem of nuptiality. Nuptiality is an extremely complicated demographic process since families are formed through marriage; but both theoretical and applied demography ignores it. Two factors are responsible: (a) the old, longstanding underestimation of nuptiality in the system of reproduction processes; and (2) the great complexity of studying and modelling it.

So far there has not in fact been a single serious attempt to model the formation of married couples; and tables of nuptiality are seldom compiled, so that it is impossible to make dynamic and territorial comparisons. Attempts to investigate nuptiality in a social aspect are few and far between. In fact we have only a speculative knowledge of such processes as the broadening of the range of marital unions, the break-up of marriages as a result of differential migration, social mobility, and ethnic assimilation

through marriage, and so on. There are only isolated works, often primitive in their method, on the stability of marriages; all this poses very difficult problems in investigating reproduction. At the same time all specialists intuitively feel that it is precisely in the field of nuptiality that certain not quite clear but very important processes are now taking place. They call for intervention, but it is impossible to make scientifically valid recommendations as there is no adequate theory and no firm foundation of facts. Hence the numerous hasty propositions that are thrown up. Meantime the problems of nuptiality call for deep theoretical treatment; further development of the theory of reproduction is impossible without it.

A second problem, extremely weakly investigated, is that of the dynamism of demographic processes. Around the last quarter of the nineteenth century it was accepted that demographic processes were in essence immobile. Investigators in centuries past did not in general concern themselves with the time changes in them. It was understood, of course, say, that natality and mortality changed from year to year through the effect of various factors (crop failures, epidemics, wars, and so on); but it was believed, all the same, that these changes were of a transient character and that the indices varied around a certain level that was considered normal and was tacitly accepted as invariant. Each investigator therefore usually verified the calculations of his predecessors, and all together searched for certain valid quantities or some "God-given order". This approach was also reflected in later work.

In improving the method of compiling mortality tables, Russian demographers strove to get a precise idea of the death rate in Russia; but although some mortality tables differed from others in a decade, no one actually spoke of the dynamics of the death rate. The situation was the same as regards natality and nuptiality. Muret's data on nuptiality, relating to one canton in Switzerland, were used in many European countries for around a hundred years, and their use inspired no doubts in anyone. One could find recommendations in the demographic literature on avoiding chance influences when compiling mortality tables, and on not taking years when epidemics

or crop failures had occurred when averaging the data for many years, and so on.

At the end of the last century and the beginning of this the position radically altered. No one could any longer ignore the rapid changes in the birth and death rates. In place of the idea of the immutability of a certain "true" level of demographic indices, there came a belief in their facile mutability. So lowering of mortality was recognised as the result of the general progress of hygiene, public health, prophylaxis, health protection, and the standard of living, while life span was considered an adequate indicator of the general well-being of the population. The same features were ascribed to natality. It seemed to fall in years of war and crisis and then, with crisis-free development, would rise.

It was also comparatively simple, it seemed, to affect demographic processes; it was sufficient just to pass certain laws relating to divorce, abortion, and so on. Life, it seemed, confirmed this point of view: the depopulation threatening France and the "population explosion" threatening Japan were averted by a demographic policy of vigorous measures; and mortality was steeply lowered in certain developing countries. But in recent decades the deficiencies of this position have become obvious. Mortality has become stabilised in economically developed capitalist countries; and despite the advances of medicine and rise in the standard of living demographic policy in India and other countries has not brought rapid and appreciable results. The experience of the past has begun to be rethought more deeply.

The depopulation that threatened many countries in the 1930s did not happen anywhere, although no special measures were taken in many countries. Divorce rose, despite legislation; and the banning of abortion simply drove it "underground". The idea of the easy controllability of demographic processes had to be abandoned. Voices are now being heard again, it is true, calling for vigorous measures to be taken promising rapid and effective results; but they are mainly those of people not specially versed in these problems. Specialists have begun to express themselves much more circumspectly.

A new conception has gained currency that can be formulated more or less as follows: demographic processes

are very complicated and peculiar; they are governed by a complex of social and economic factors but have a certain independence and great inertia. Any policy measures must be distinguished by stability and far-sightedness, and their results will make themselves felt over a long time. This point of view has now become very common, in an open or a veiled form, and is affecting both the methods of demographic research (the cohort approach) and the direction of factor analysis, more attention now being paid to stable factors (education, occupation). New approaches to the problems have been developed. Demography has begun to study the traditional ways of life, morals, and family structure of different peoples, and their social psychology (views, maxims, attitudes, and prejudices). Attention had, of course, been paid to these matters earlier, but only as secondary things obscuring the picture and preventing one from seeing the main trend. Now, however, they are being seen as important factors directly determining demographic behaviour. It is now accepted that the basic factors ultimately governing all social processes, including demographic ones, do not affect them directly but through a number of intermediate steps. The explanation of the inertial character of demographic processes has been found in the conservatism of traditional ways of life and the system of values, maxims, and attitudes. This trend in research is really only just beginning, but it promises to yield a great deal in the sense of understanding the processes of reproduction.

It is now important for this new stage to find reflection in theoretical demography. The cohort method of analysis is being very broadly developed, but it is still very imperfect in theory. Only the demographic behaviour of individual cohorts is usually investigated, each of them being regarded as independent. There are no synthetic reproduction rates using the data of cohort analysis; in the hands of the researcher population as a whole is ceasing to exist, but is being broken down into separate cohorts; and there is no method of synthetic description. At the same time the independence of the separate cohorts is as much a fiction as the independence of the processes in different age groups, since it is the reverse of one and the same approach. The behaviour of each generation

and of each cohort is linked socially and demographically with the behaviour of all the other cohorts living at the same time; we know that, but we do not know how to describe it and measure it. This is felt most clearly in the field of nuptiality, where many cohorts of the marriageable are involved in moulding each marital cohort; but there is no model for describing it.

The cohort approach to analysing reproduction also faces researchers with other interesting problems. It is a traditional precept in demographic analysis to avoid the effect of structural factors, it being considered that structure is the result of the history of the population shaped by the past, and that, in order to understand what is happening now, it is necessary to eliminate its influence as obscuring the real essence of the process. When the cross-sectional method of analysis predominated that was quite justified; but with the cohort method doubts arise. The behaviour of each cohort is considered at any moment to depend on its whole history, and all its characteristics, both momentary and cumulative, are considered a single interconnected system; only in that way can the integrity of the historical approach be ensured. But in that case each index taken separately is linked with the history of the reproductive group, and any structure reflecting the group correlations of individual cohorts determines the intensity of the process not only as a set of "weights" but also directly. In that case structure is considered not as something fortuitous, incidental, and transitory, the effects of which are to be avoided, but on the contrary as a result of the history of the given population. In order to understand what is happening today one cannot and must not eliminate its influence but must study it and understand it, measure it, and take it into account.

The question also arises of the interconnected character of structures with different attributes, since each of them is the result of one and the same history; structural characteristics can therefore also only be analysed in a co-ordinated way. All these problems have not yet found reflection in reproduction models.

In recent years there has begun to be much talk about the quality of reproduction. This aspect used to fall outside the field of vision of demographers although it

was of very great significance. Here one may mention two aspects, the medico-genetic and the social. As regards medico-genetic problems, they mainly belong to the field of population genetics and are weakly linked with purely demographic problems. And although such matters as the circle of preferable marital unions or consultation on a possible deviation in the state of health of the offspring also have a demographic character, their quantitative effect (at today's level of knowledge) is insignificant. Only one problem may possibly have real significance on this plane in the future, and that is the question of preference for children of one sex or the other if it should become possible to control it in practice. The sex proportion of the newborn has an enormous effect on the whole demographic history of a generation, and the admissible deviations are very small. It is possible that control of sex proportion will become of vital concern to demographic policy in the future.

As regards the social problems of the quality of reproduction, there are many complicated tasks that still lack theoretical solution. Problems of the reproduction of separate occupational groups can be modelled by the classical methods but we do not in fact know how to approach the problem of modelling reproduction of the whole occupational structure. The approaches to it available are very primitive and have not got free from the fetters of matrices of social mobility. At the same time, the process itself (reproduction of occupational structure) is very complex, and the possibilities of reproducing persons of a certain standard of professional or vocational training are limited.

In order to train a doctor much work has to be put in by specialists in the most varied fields (teachers, biologists, physicists, doctors, and so on). The reproducing of specialists of various professions is therefore an interconnected process. A population desiring to reproduce doctors at a certain rate must have the possibility of reproducing biologists, chemists, etc., at corresponding tempos. One can compile matrices of occupational reproduction indicating how much labour must be expended (in man-years, say) by various specialists in order to train one specialist. As a first approximation these matrices will resemble the schemes of the intersectoral input-

output tables used in economic planning, and will give a true picture of reproduction of the occupational structure of population. Taken in combination with matrices of social and occupational mobility they can help us to understand this complex process. It is possible that it will be by just such an approach that we shall succeed in passing from scholastic arguments about optimal rates of reproduction to concrete investigations of the reproduction of optimum structures.

Reproduction of the ethnic structure of a population is a problem rather apart. Quite understandably one cannot look on the population of the multinational Soviet state as an aggregate of independent ethnic communities. The processes of ethnic interaction both in the social sphere (convergence and mutual influencing of cultures) and in the demographic sphere (mixing of ethnical communities in the course of reproduction) are proceeding so intensively that such a standpoint is clearly unsound. But the processes of the interaction of ethnic communities during reproduction are so complex, and have been so poorly worked out, that there are no clear ways of modelling them. Certain fundamental questions have not in general been satisfactorily resolved.

The great number of indeterminate cases of ethnic affiliation prevents us from constructing the formal classification that is a necessary precondition for building a model. At the same time the ethnic factor is acquiring ever greater importance in analysing and forecasting the dynamics of population because both natality and mortality depend to a considerable extent on the history of a given nation or people, on the special features of its way of life, traditions, culture, customs, attitudes, maxims, and so on. It must therefore be thought not only that today's differentiation of reproduction patterns is determined by ethnic structure but also that the future dynamics of reproduction will in large measure be governed by cultural development and mutual influence of peoples. For example, the future dynamics of reproduction of the population of Central Asia, which is distinguished now by high natality and low mobility, will depend on how far each succeeding generation, each succeeding cohort, adopts and reproduces the views and behaviour of the preceding cohorts, and how far they

will be found to be influenced by the views and principles characteristic of the other peoples of the Soviet Union.

No population can exist outside time and space. The pattern of reproduction varies regionally in an essential way, which is particularly noticeable in the differentiation of natality. At the same time the territorial distribution of population and its social and economic characteristics exert a real influence on the pace of a country's social and economic development, and that of its parts.

Chapter 3

POPULATION DISTRIBUTION

V. V. Pokshishevsky, D. Sc. (Geog.)

Migratory processes and the settling of population are due to objective processes of social development and the operation of socio-economic laws. Migrational flows and settlement reflect shifts in the geographical location of industry and are organically linked with development of the economy.

A very essential concept in the system of scientific knowledge of population is that of settlement, which holds a central place in population geography. This concept signifies, on the one hand, the process of the consecutive territorial spread of population, i.e., the course of its settling in all its complex dependence on historical and economic preconditions (one may say, for example, that the boundaries of today's oecumena have been formed as a result of the settlement of people over the land surface of the world over such and such a time interval). On the other hand, the term "settlement" means the results of the process mentioned above, i.e., the spatial forms in which the settling of people took place. The two approaches are closely interlinked. If we use the term in the first sense, the original territorial organisation of the population will depend on the character of its settling.[1] On territories settled for the first time, an

[1] The territorial organisation of population is not only its grouping by forms of settlement (towns, settlements, villages,

"original" network of populated points is formed in the course of their settling, and these points immediately begin to interact with one another (as organisational, economic, production, administrative, and similar centres; and in the past, too, as fortified military posts). The skeleton of the "first layer" of populated points created during gradual settlement is then overlain by successive "layers". The process was characteristic, for example, of the interiors of the United States, Canada, and Australia.

The main pattern of settlement is its ultimate dependence on the areal distribution and territorial organisation of social production.[1] Human society is above all a collective of producers; the territorial settlement of people, their distribution in the regions of a country, and their grouping in settlements, or groups of settlements (from the tiniest hamlet to multimillion cities) are therefore determined primarily and mainly by the geography of production. People settle down "here" and not "there" because they find opportunities "here" to produce the goods and wealth without which their very life is impossible.

But the territorial spread of settled sectors through the migrations that created such "settlers' colonies" in the past was stimulated in turn mainly by productive motives: on the one hand for the benefits to be derived from bringing the natural and economic resources of these areas into the geographical division of labour, and on the other hand by factors of the "pushing out" of people (also primarily for economic reasons) from the countries or areas from which they emigrated.

The laws of population geography are special patterns of economic geography based in turn on the most general economic laws proper to the social formation for which a population is being studied (and also, of course, on still more general propositions of dialectical materialism

farms) but also the system of connections between these elements, their coverage by social and cultural services, the hierarchy of their co-ordination as regards administration and the economy, and so on.

[1] More exactly reproduction, since the "geography of the consumer pole" of the process of social reproduction is also important in the distribution of population and its employment (including in the non-material sphere).

on the interrelations of society and the natural environment of its development); but these special laws are not to be classed as secondary ones, as they are essential for concretising the more general laws. Recall Lenin's words that "the universal exists only in the individual and through the individual. Every individual is (in one way or another) a universal. Every universal is (a fragment, or an aspect, or the essence of) an individual."[1] It would also be wrong to think that the laws of population geography are already included, "ready-made" so to say, in the more general socio-economic laws; they can be deduced from them and developed, but only by a special creative effort for which a special method is needed, and which must draw on the data of allied disciplines.

Examination of the concrete picture of settlement in any part of the world brings out clearly the connections between the distribution and territorial organisation of the population and the character of the area's economy.

The idea of the ultimate dependence of people's distribution and their forms of settlement on production factors has become widely accepted in the Soviet literature. The dependence is not only characteristic of socialist society but also of the social formations that preceded it (although the mechanism whereby production affects settlement will be modified, of course, in accordance with their features).

In that sense the patterns of which we speak acquire a certain universal significance. "The law of the correspondence of the form of settlement to the mode of social production (and the superstructure) is inherent in all social formations," writes V. G. Davidovich.[2] Similar ideas have been expressed more than once, by Y. G. Saushkin[3] for example, and by others, including the present writer. It has been remarked that the very populousness of individual inhabited centres[4] is usually linked with the

[1] V. I. Lenin. On the Question of Dialectics, *Collected Works*, Vol. 38, p. 361.

[2] V. G. Davidovich. *Rasseleniye v promyshlennykh uzlakh* (Settlement in Industrial Centres), Moscow, 1960, p. 17.

[3] See Y. G. Saushkin. Geographical Study of the Rural Populous Points of the Soviet Union, *Voprosy geografii*, Book 5, Moscow, 1947.

[4] The populousness of inhabited points is usually taken as the numbers of the population living in them.

economic functions performed by them, while the density of the population of whole regions reflects their level of economic development.

Not only is the localisation and territorial organisation of the population governed by the geography of the economy (including, of course, the mode of production), but its structure or composition (by class connection, trade or occupation, and employment in the various spheres of the economy, and to some extent even by age, etc.) also reflects the character of the social production being carried on in any particular area or country at a given moment.

The social-production structure and localisation of a population are important concepts in population geography. Their outward expression is a certain system of settlement.

The dependence of the distribution of a population, and of its territorial organisation and migratory redistribution on the development processes and spatial shifts of industry, is the main and "primary" law of population geography. One can justify it with numerous examples from real life, and from the complex historical experience of various countries, socialist, economically developed capitalist, and developing; but these examples often also indicate the existence of "secondary" laws by virtue of which the distribution pattern of a population already formed may in turn affect the location of industry. Thus densely populated localities prove (other conditions being equal) to be a relatively more favourable milieu for the location of labour-intensive undertakings (both industrial and agricultural). Big cities also "attract" much industry to them, especially industries requiring highly skilled and qualified personnel, close links with scientific and educational institutions, laboratories, and design bureaux. These "secondary" laws include the dependence of the geography of certain industries on the distribution of the superstructural elements of the social organism. The printing industry, for example, is often drawn to centres of literary and publishing activity.

Taking the world as a whole, concentrations of population display considerable stability over long periods of time. The researches of historical demography and historical geography permit us to affirm that, at the beginning

of our era, 75 per cent of humanity lived in the now most densely populated areas of East, South-East, South, and South-West Asia, and in Western and Central Europe; in the eighteenth century up to 80 per cent of the total population of the planet; and 75 per cent in 1900 (now, I estimate, around 70 per cent). In essence there has been only one significant new concentration of population in the past two hundred years, that in the eastern part of North America.

In addition to this stability in the distribution of the bulk of the world's population, outlined in broad strokes, smaller areas of settlement have been historically very mobile, both within countries and within the regions of countries. The general patterns here (especially noticeable in recent decades) are the following: (1) accelerating urbanisation (which reflects the growing role of the industrial basis in the economic life of most countries), which is often accompanied with an absolute decline in the numbers of the rural population (in the course of urbanisation not only is there an increase in the proportion of the urban population in general, but also in the weight of the population in big cities, which are becoming the focal centres of concentration of industry, flow of information, and the functions of controlling all social and economic processes); (2) ever broader spread of group forms of settlement and urban agglomerations; (3) penetration of the urban way of life into rural localities ("urbanisation of the countryside").

As a result of these processes the "picture" of settlement is changing essentially; its rural background is literally becoming relatively fainter and "urban patterns" appear more sharply, becoming more and more so in the big centres appearing on the map. In the USSR, for example, more than four-fifths of the total urban population live in territorial groups of urban settlements.

With spontaneous capitalist growth of urban agglomerations (conurbations) some of them are becoming transformed in gigantic concentrations of what are known as "megalopolis" in the United States (the almost completely urbanised belt from Boston to Washington). Very large conurbations are also often building up in developing countries; the tragedy of these concentrations

of people is that these agglomerations do not have a sufficiently developed economic base to employ the great masses of people being driven out of rural areas by lack of land, by want (which is growing all the time as commodity-money relations penetrate the village), and finally by simple, elementary hunger. Market forces are, as it were, washing these waves of despairing people into the largest cities.

An agglomeration of towns or conurbation is a complex formation. It cannot be considered a mechanical concentration; within it elements of a common economy are always being formed (either spontaneously or in a planned-way), e.g., power supply, quite often common water-supply installations, and a joint construction base. And the population of a conurbation lives a common life. Many travel to work in a neighbouring town, and journeys for cultural and social purposes are frequent. The network of institutions serving it also proves to be more or less common; everyday services (schools, shops, cafes and restaurants, primary medical care institutions, and so on) spring up in all populated points, while enterprises and undertakings of a more complex type, to which the public does not have recourse so often (specialised medical care, theatres, shops selling consumer durables, etc.), may prove to be concentrated only in the largest towns, the centres of the agglomerations.

Certain characteristic types of conurbation can be established. Thus a common type is the agglomeration formed around some very large city by its satellites. Such conurbations (Moscow and Paris are examples) are called monocentric. Occasionally they acquire a linear character, the towns forming them stretching out in accordance with the micro-geography of some town-forming factor—along the banks of a river (e.g., with the location along a river of many enterprises processing timber rafted down to them), along the sea coast (the "megalopolis" mentioned above; the Tokyo-Yokohama conurbation with the many towns gravitating to these main centres), along the belt of occurrence of some mineral or other. Conurbations arising on the basis of use of mineral resources may also have the character of an area concentration without a clearly marked centre (the Donbas, the Ruhr). In general the areal model of

agglomerations, like the character of separate towns, is mostly determined by their industrial functions.

Explanation of the degree to which natural conditions affect the distribution of population and its territorial forms of settlement is vitally important. The locality undoubtedly has such an influence, and its effect is frequently most significant, but it is only exerted indirectly through industry, creating certain conditions for its distribution and localisation. It can even be traced in rural localities, where, it would seem, soil fertility, the availability of moisture, the relief and other features of the natural location must condition the whole picture of settlement in a powerful way. But it is not difficult to discern that these natural features are not important in themselves but as the conditions for carrying on agriculture. One must always allow for the "human" factors themselves among these conditions, i.e., the level of technique, the character of the society's needs and the social organisation of the producers taken in its areal aspects (e.g., in the USSR the size of collective and state farms, the scale and territorial structure of the land area used by them, the labour-intensiveness of the crops cultivated, the character of mechanisation; in the United States or Canada the economic features of farms have a similar significance, and in tropical countries the plantations).

It can be shown that the location of many of the "urban" undertakings and industries that determine the forms of urban settlement are affected by the natural environment (the comparative wealth of a country or area in raw material resources, fuel, and power; geographical position in relation to natural lines of communication or sectors where artificial ones can be built, etc.).

The direct influence of natural conditions on forms of settlement is only traceable in the choice of the sites themselves for populous points or housing estates. But here the natural, geographical environment already functions as a technical factor, and the mechanism of its effect is a purely engineering one, i.e., the technical possibility of building on sectors with a certain slope; the need for some kind of civil engineering preparation of the area; the availability of water supplies; the conditions for the disposal of effluent, and so on.

This mechanism, however, is also "historical", for the engineering appraisal of a site depends on the one hand on the level of development of the productive forces, on the capacity of technique, which determines, for example, the feasibility of improving unfavourable sectors, and on the other hand on society's needs in the building of inhabited centres of just this size and type (which is once more ultimately determined by the character of the geography of industry). Areas that it is "too much" to open up with a lower development of the productive forces become quite feasible with a higher development or another mode of production. On the contrary, the needs of social production and the forms of settlement linked with them may bring criteria to the forefront in the appraisal of such areas unimportant earlier. Thus even a narrowly engineering, geographical appraisal of the micro-geographic position of populated places and their areas undoubtedly includes social and economic factors in the long run.

In the overwhelming majority of cases migratory shifts in the distribution of population are caused by social and economic factors. Such, for example, were the mass transoceanic migrations from the capitalist countries of Western Europe to the United States, Canada, Argentina, and Australia; in Russia the pre-revolutionary peasant resettlement in Siberia; and the settling of emigrants from China in the countries of South-East Asia, which was especially strong during the creation of capitalist plantations there. The economic motives of a need for labour on plantations gave rise to the slave trade, "throwing" tens of millions of Africans from the seventeenth to the nineteenth centuries into South and North America (although for the Africans themselves, who were the "object" and not the "subject" of this forced migration, it was a monstrous calamity, and barbaric, extra-economic compulsion).[1]

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[1] The American historian Philip Curtin, who has studied the volume of the slave trade, suggests that 40 per cent of the flow of slaves was settled in the countries of the Caribbean Basin, and 38 per cent in Brazil. American sources, however, usually consider the volume of the slave trade "on arrival"; but, as we know, between a third and a half of the slaves died *en route*. In Africa itself, too, bloody wars were waged in order to capture slaves.

The present-day importing of "temporary" labour, especially of unskilled labour, into the economically developed capitalist countries of Western Europe is also determined by the economic situation.

In the socialist countries planned development of the economy creates a need for reinforcing the manpower resources of especially rapidly developing areas with new contingents (e.g., the eastern areas of the USSR need such reinforcements). A variety of economic levers is used for the appropriate inter-regional resettling of population; but the patriotic feelings of young people are also appealed to (departure for new areas in response to public appeals), young specialists are directed to work, and so on. In all these cases the grounds for migration are economic.

This picture of the economic causes behind the resettlement of population is sometimes obscured, however, by migration without economic causes. During the twentieth century there have been changes of political frontiers, exchanges of population in accordance with national or religious affiliations, and so on. One must also note the migrations of refugees connected with the oppression of certain peoples and of harsh repression of their struggle for their rights.

The significance of migration in the development of the productive forces can prove to be very great. It ensures extension of the tilled agricultural area and the drawing of mineral resources into economic turnover, leads to the creation of new cultivated landscapes, and so on. Because migratory processes take place in very different social and historical conditions, they must necessarily be studied at each stage taking the social structure of the country and the mode of social production dominant in it into account. As for the natural and geographic environment, it merely creates the conditions in which the migrations occur, but cannot be their cause, for their driving force always lies in the sphere of the relations of social production.

The migrations in the USSR since the victory of socialism have differed decisively in their motivation and

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The total loss of population to Africa through the slave trade is estimated at around 100 million persons.

character from the pre-revolutionary resettlements. Whereas the earlier movements of population had had a spontaneous character and had been caused by the acute need of the people who changed their location in a vague hope of somehow improving their standard of living, the movement under socialism has been mainly planned. With socialist organisation of production general, and the rise in the material condition of all the people, the very concept of "relative surplus population" engendered by social relations has disappeared.

Thus the driving forces of migration have themselves become different than in old Russia. Now they are due not to phenomena of stagnation in the districts of emigration (in the USSR, which does not suffer from unemployment, there are no districts where there has not been development of the economy), but to positive tasks linked with further growth of the productive forces, in the solution of which the whole people are taking part. The transferred population is consciously directed to areas where the application of labour to previously underutilised natural wealth (land, minerals, etc.) yields a high productive effect, and ensures the production of considerable material wealth both for the settlers and for the whole economy of the country.

Understanding of the course and results of today's migrations in the USSR (e.g., the attraction of population to virgin lands or to new industrial centres and towns) makes it necessary to study the processes of the industrial opening-up of new territories and of the natural and economic resources concentrated in them. The new character of the migration itself is also giving rise to new trends in its study.

The need for internal migration in the USSR is determined by the necessity of transferring population in accordance with the changing location of industry and of ensuring the fullest use of natural and economic resources according to their value to the people and to the state.

A characteristic of present-day internal migration in the USSR is that those involved are, as a rule, vocationally trained persons (skilled workers, engineers, operators of agricultural machinery, and so on). In planned recruitment for areas needing additional man-

power, training and the appropriate skills are taken into account. The sharp reduction in the volume of seasonal migration is a consequence of qualitative changes in the production sphere itself; the mechanisation of agriculture, lumbering, fishing, and other industries that used to have a seasonal character has made it possible gradually to eliminate seasonal work in them and to carry them on mainly with regular workers with special training, which has fostered population growth in a number of areas.

The bulk of post-revolutionary migration within the USSR has been linked with growth of the numbers engaged in industry, and with the creation of new centres and areas of industry. In connection with the general shift of industry population has been transferred to the Urals, Siberia, the Far East, Kazakhstan, Central Asia, and the Far North. Important centres attracting migrating population in 1960-70 were Kazakhstan and the republics of Central Asia. According to the census figures for 1970, the balance of migration to those areas in the period since 1959 has been plus 1,200,000.

The forming of new centres of settlement has often been linked with the laying of new railways. Thus the building of railways in Central Kazakhstan encouraged growth of the cities of Karaganda, Balkhash, and Jezkazgan, which are centres of the coal and non-ferrous metal industries. The building of the Northern-Pechora trunk railway speeded up the development and settling of new oil and coal centres in the Komi ASSR, and attracted population connected with lumbering to the belt along the line. The building of the Baikal-Amur trunk railway will lead to the creation of a number of new industrial complexes in Eastern Siberia and the Far East.

As regards migration due to the development of farming, its scale has been much more modest. In several areas there has been local resettlement linked with the opportunity to use land resources more efficiently. In the Caucasus there has been a resettlement of mountaineers on the plains in several areas where better land, taken from them before the Revolution, has been returned to them. There have been a number of important migrations in farming areas of Central Asia in connection with the extension of irrigated areas and the building of major new irriga-

tion canals; but they have been of a local character. In the 1950s internal migration to the virgin lands attained a considerable scale.

Whereas in areas receiving population study is made of the course of the original opening-up of the areas, the settlers' struggle with nature, the cultivated landscape,[1] and the farming and industrial centres created by them (this land-cultivating activity takes on different forms in different social conditions), study of the areas of emigration helps to clarify the social reasons for the migration. In countries with an antagonistic class structure, the reasons are the class contradictions and signs of economic stagnation or decline of the areas concerned (which causes an exodus, occasionally even a flight of population). Instructive in this respect are the examples of the Massif Central in France, the loss of population from many mountain areas in Italy, and the exodus of population from the north-eastern states of Brazil (where a host of survivals of the slave economy is characteristic and retards development of their economies). In the United States the 1970 census revealed a marked exodus from the central states, with a simultaneous flow both to the east and to the far west of the country. Underlying the formation of such centres of stable loss of population there is always a lagging behind of economic development, and often a protracted agrarian crisis caused by social factors and localised in certain areas of the country.

What has been said above helps us to understand why it is mistaken to seek the causes of migration in the simple overcrowding of certain areas and a "vacuum" in others, and to suggest that this "vacuum", "automatically" as it were, sucks in population from more densely populated areas.

An important aim facing the researcher in the course of a complex study of population is to translate all the conceptions of the interdependence of the geographical location of population and the economy into the language of quantitative indices. Thus it would undoubtedly be of interest if we could bring out the correlations of the concrete processes of urbanisation and growth of the

[1] Let us note here that the less an area was previously settled, the greater does the arrival of even a few settlers alter its geographical physiognomy.

industrial volume concentrated in any one town. The writer has tried to do so by comparing the size of the urban population of the USSR (by Union republics and a considerable number of autonomous republics) in a base year (Y_0) and a subsequent year (Y_1), and the corresponding volumes of production (P_0 and P_1) for 1940-1965. The following ratio was obtained for the USSR as a whole:

$$k = \frac{P_1}{P_0} : \frac{Y_1}{Y_0} = 3.8.$$

The difference in the value of k for different republics brought out features of the combination of urbanisation and industrialisation in them.

It is also important to disclose the relation between the hierarchical co-ordination of the industrial levels in industrial centres of various "rank" and the number of inhabitants of the corresponding centres of population, between the growth of labour productivity in agriculture, on the one hand, and the numbers and distribution of the labour contingents employed in this industry in settlements of various size, on the other. One could list many more tasks arising here, and convincingly show the important practical significance of such dependencies for macro-economic planning.

Disclosure of the "reciprocal" effects of the distribution of population on the development of industry has its own place in the business of elucidating the mathematical ratios arising here.

Let us note, too, that quantitative approaches to analysing the links between the distribution of population and its employment in various spheres of activity can greatly help us to understand the significance of the localisation of the population engaged in the non-material sphere (service industries, science, and so on). This is an important new trend in population study (including its geographical aspects).

* * *

Scientific analysis of population problems must be based on Marxist economic theory. These problems are conditioned by the historical process of social develop-

ment, and the laws of population development must be considered in connection with the Marxian periodisation of history. An historical approach to analysing these laws is therefore most important methodologically. The Marxist-Leninist theory of population makes it possible to reveal the effect of the productive forces and relations of production on the working and living conditions that determine the reproduction of people (social mobility, natural replacement of generations, migratory processes), on population development patterns.

Study of population by a broad range of sciences helps to elucidate a host of matters more fully, to avoid a one-sided approach, to provide real practical possibilities, to employ the results of research for purposes of social forecasting and macro-economic planning in developed socialist society, to bring out the real population problems in developing countries, and to show how they are conditioned by the socio-economic processes taking place in them.

The development of population science (and of its "kernel", demography, which itself is becoming a system of sciences) is a new stage in the development of the social sciences, and is an important instrument in the building of communism.

Section Two

METHODOLOGY OF POPULATION STUDIES

As an object of study population has a variety of characteristics, and a large number of constantly changing attributes are typical of it; in analysing its development, therefore, we can only single out some one attribute "in pure form" in a very conditional and arbitrary way. The complexity and many-sided character of the object of investigation makes it necessary in demographic analysis to employ the whole complex of varied approaches to their study employed in economics and other sciences. That applies above all to the most fully developed statistical methods of analysing population. Population geography, ethnic demography, and public hygiene study population from their own specific standpoints. This section of our book is devoted to the methodological problems of complex study of population.

Chapter 1

THE SYSTEM OF SCIENTIFIC KNOWLEDGE ABOUT POPULATION

D. I. Valentey, D. Sc. (Econ.)

In recent years Soviet scientists have done not a little to clarify the theoretical and methodological aspects of the development of a system of scientific knowledge of population. Population development patterns are becoming the object of attention of an ever-widening circle of specialists in the social and natural sciences. By population development we understand here the quantitative and qualitative changes in a population caused by processes taking place in society as a result of development of the powers and relations of production. Special interest is being evinced in the methodological problems of all-round integrated study, as is shown by the growing role of this trend in the Soviet Union and is confirmed by the voluminous literature on the theory of complex analysis of population problems and by the many conferences and meetings devoted to them being held in Moscow and other Soviet scientific centres.

Underlying integrated study of population development patterns is creative application of the methodological principles of the social sciences, i.e., of Marxist philosophy, political economy, and scientific communism, which are the basis on which the general theory of population is also built. In the past population phenomena were usually studied in a rather one-sided way; for example, the effect of income level or of living conditions on the birth rate. Such an approach, while possible (and

sometimes necessary) in principle, frequently leads to study of the problems from partial positions and to underestimation of the complex links between the processes of reproduction and other social phenomena.

Recognition of the close link between reproduction and living and working conditions is at the same time recognition of the host of ways in which reproduction processes depend on other social processes; and it is impossible to study this dependence and these connections by the techniques and methods of demography alone with the broadest interpretation of its subject matter. Hence the close link between demography and the general methodological sciences and other social sciences in a system of population sciences extending the sphere of application of demographic studies and creating a solid basis for studying population by a complex of sciences.

The subject matter of the system of scientific studies is population development patterns, changes in working and living conditions, reproduction in the broadest sense of the concept (social mobility, natural replacement of generations, migration in its various forms, settlement, qualitative changes including general education, vocational and special training, and health). Each of these forms of movement is studied in varying degree by certain sciences; but the socio-economic conditionality of their causes lies in the patterns of societal development.

In our day, as we know, science is developing along two outwardly contradictory paths: parallel with a process of hiving-off and specialisation there is an integration of sciences of a borderline character through synthesis and mutual enrichment of the accumulated knowledge of allied sciences. Population science is being enriched by bordering, adjoining disciplines, many of which have been hived off from long-established sciences. The integrated approach to studying population as a complex object is a new path in the methodology of investigating social phenomena.

It is most important for further development of the theory and methodology of multiple analysis of population development patterns to establish a theoretically valid classification of the population sciences, bringing out interconnections of the different sciences on the basis of certain principles, and linking them up logically

into a single system. The classification of the sciences studying population in one way or another is governed (1) by the objective connections and relations of the subject studied; (2) by the methods and conditions of cognising the objects of the sciences (in particular, by the reliability and fullness of the statistical information); and (3) by the aims giving rise to and served by these sciences.

The classification must stem, above all, from the structure of the object studied. It is therefore necessary to say what the structure of population is as an object of research, what are the aspects and connections studied by the system of sciences with which we are concerned, and what they have most in common.

On the basis of this classification one can select various aspects of their general connections, classing them logically by the following principles: (1) from the more general to the more concrete sciences, and (2) from the simple to the complex. One can also classify the sciences according to their time of origin, using as a basis the history of demography or of the social sciences in general. The classification can also express the principles of the transition of our knowledge from one aspect of the object of investigation to the aggregate of all its aspects. At the same time it is clear that the logical structure of the scientific field can only be established by taking the knowledge obtained in a definite order after systematising it.

The development of population studies from a complex to a system, the formation of a system, requires its structure itself to be grasped. Population theory, naturally, is based on the general methodological sciences, and it is normal to put it after them in the system of population sciences, followed by demography and its contiguous sciences, like manpower and labour economics, population geography, family law, certain fields of ethnology, social psychology, public hygiene and gerontology, population genetics, and a number of other sciences.

Each of these components, in turn, is a whole system of scientific population studies. Population economics, for example, assumes analysis of the ratio of the production and consumption of material wealth, of social and personal consumption, and of ways of satisfying them

in the interests both of societal development and of each individual. Population sociology is just such a complex system.

The "core" of this complicated ensemble of knowledge is demography. Its development is a history of struggle between, in the main, two points of view on its subject matter, which, in the one view, consists simply of analysis of the problems associated with the natural reproduction of populations, but in the other view is much broader, embracing a whole series of already established, independent social sciences. We are not inclined to agree with either view. In our opinion the subject matter of demography is the reproduction of a population in its socio-historical conditionality, i.e., in the broadest interpretation of the concept. In fact, whereas we used to speak of demography as a single science, a transition is now noticeable in its evolution toward a new stage, with demography being gradually converted from a complex into a system of demographic sciences developing on the basis of the general theory of population.

The determining basis for all the sciences in this system of population knowledge, including demography, is the Marxist-Leninist theory of population, which synthesises general methodological propositions on the development patterns of a population. The methodological disciplines help define the subject matter and methods of the demographic disciplines, which (while based on the theory and method of cognising socio-demographic processes and phenomena) investigate concrete problems. Theoretical demography as a whole is based on the principles of the general theory of population, and has the job of developing the basic methodological principles for analysing socio-demographic processes and phenomena, and the reproduction patterns of a population. This science defines both the system of demographic studies and the place of each special demographic science in the system, and enables the scientist whose interests draw him to one or another of these sciences to delimit its subject matter and to establish the role, place, and significance of any one method, and of the concrete method and technique of analysing socio-demographic processes. While being itself based on general population theory, the job of theoretical demography is to lay the foundation

for developing all the concrete demographic disciplines, including such new theoretical socio-demographic disciplines as economic and historical demography.

The future development of demography will undoubtedly call for a clearer demarcation of the subject matter of theoretical demography as a methodological science, the basis for building up the system of demographic sciences, and the basis for the development of special demographic disciplines.

Theoretical demography also has to establish the true place of the traditional methods of studying population. Descriptive demography, for example, has a special place among the demographic sciences; and it could serve as the foundation for a broad circle of researchers in the field of concrete demographic sciences which cannot now limit themselves simply to determining the quantitative aspect of the process.

Descriptive demography is of great significance for development of the history of demography because, without empirical data (which must be elucidated within the framework of population statistics), the theoretical demographer will scarcely be able to rise to higher new levels in analysing population developments, including the quantitative changes that are taking place in it in the course of social development in connection with the scientific and technological revolution. Improvement of population statistics will make it possible to define the place of empirical data in generalised statistical form in demographic research, and to avoid an excessive passion for collecting facts without deeply comprehending them and, on the other hand, to avoid theorising in isolation from the assembled factual material and fitting it into formal schemes.

An exceptionally important subdivision of the system of demographic sciences is economic demography, the job of which is to analyse the effect of demographic factors on the economic development of society and the influence of socio-economic development on social and demographic processes. It, too, is having to grapple with the new trend in research, i.e., population economics, and to delimit it from economic demography. The development of historical demography also presents much interest; this is the branch of demography that

studies the history of demographic development of the population of the world, and of continents, separate countries, and economic regions, and the features of the interconnection in separate countries or regions between economic and demographic processes at various stages of their development.

So far such a trend as applied demography has not been adequately developed; it itself is a system of applied demographic disciplines of enormous significance for macro-economic planning. Some demographers consider its sphere to be demographic studies devoted to the results of applying the methods of demographic analysis to concrete problems of reproduction in separate countries and economic regions (in our view these matters belong to the subject matter of regional demography), while others limit it to the concrete problems of some branch or sphere or other of the economy connected with meeting the growing material and cultural needs of the population. It is a matter of determining a population's needs (both their scale and structure), given its existing and expected age, sex, marital, and educational structure, for goods (food, clothing, medicines, medicaments, and so on); and also of determining the size, types, and structure of housing, the system of communal services and amenities, and the scale of development of the non-productive sphere (education, medical care, and culture). In practice applied demography needs to be used to work out the long-term perspective, providing the planning authorities with data on the population's economic and cultural needs (in this case it borders on population economics).

In addition to population economics, a big group of researchers is working on population sociology, which studies the system of relations and connections between social and demographic development. Demographic processes are considered in a system of social relations in connection with other forms of a population's life activity. Here the concept of reproduction includes problems of the passing on to new generations of the whole varied social, industrial, and intellectual experience. Such a definition of the subject matter of population sociology is a very promising one in our opinion, but it apparently requires the subject matter and field of investigation

to be more clearly established and the links between population sociology and economics, on the one hand, and sociology and economics in the broad sense, on the other, to be brought out.

The theory of population developed on the basis of the general methodological sciences determines the character and content of all the scientific trends in the system of population studies: namely, demography, population economics, population sociology, and the allied sciences studying population to one degree or another and its separate problems and development patterns. The theoretico-methodological demographic disciplines have a particularly important role to play: economic demography, historical demography, the history of demographic studies, and descriptive demography which enables all the methodological demographic sciences to analyse population development patterns and the socio-demographic processes being observed at the present time. On a given horizontal line of classification, therefore, it is undoubtedly necessary to leave several blanks to be filled in later.

After the theoretico-methodological disciplines comes a list of special sciences derived from the methodological ones named above, the socio-demographic processes being investigated by the methods already mentioned.

The difficulties in understanding population development patterns are that most of them result from people's conscious activity, which builds up into the resultant of millions of human acts (e.g., the birth rate at any period or the character of migration, demographic pressure on big cities). Analysis of the causes of demographic behaviour is an important sphere of joint activity for demographers and economists, sociologists, lawyers, social psychologists, and ethnologists.

Demography and its adjacent sciences, being based on general population theory, have to study the aggregate of the socio-economic conditions bringing about a given demographic situation, the changes in the intensity of the forms of population movement being observed at the current moment, and the changes in population structure.

Having determined more or less reliably the socio-economic conditions that have brought about the current

demographic situation,[1] it is extremely important to clarify its secondary consequences: viz., its economic, socio-demographic, moral, ethical, socio-hygienic, and genetic consequences. It is necessary to elucidate the effect of the demographic situation on the qualitative composition of the population (general education; vocational, professional, and special training; health); this factor is also most important in the long run for determining the optimum population at any particular period of economic development.

Only when the secondary and tertiary consequences of the contemporary demographic situation have been elucidated can an effective complex of measures be developed for population policy, so as to alter an unfavourable demographic situation. It is also the job of applied demographic sciences, we suggest, to ensure a real tying-up of fundamental research in the field of population with the tasks of macro-economic planning and social forecasting.

Population policy, the direction, intensity, and concrete content of which is determined by the character of a particular socio-economic formation, is built up from the following main elements:

1. the change in working conditions and of the working age in general, and in various jobs, determined by changing conditions of production, the level of employment, the length of the working day and week, the length of holidays, attention to labour protection, vocational and special training, career-guidance, and so on;

2. the change in the living conditions of all strata of the population (real wages or level of income; housing conditions; the possibility of enjoying communal services and amenities, and cultural achievements; the accessibility of up-to-date medical care; the degree of leisure and the structure of its use); the very important problem of combating environmental pollution also comes in here;

3. the effect on the process of reproduction (social mobility, natural movement, migratory mobility).

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[1] The state in which a population is at present can most probably be called a demographic situation representing a secondary phenomenon as regards the objective laws governing population development in the given socio-economic conditions.

Demographic policy itself, in our view, is only concerned with reproduction on the quantitative and the qualitative plane. It is an aggregate of measures regulating demographic processes in the interests both of society as a whole and of each of its members individually, and embracing all forms of population movement, since they are all closely linked and a change in one affects another.

Demographic policy is not determined solely by economic factors, although they are its underlying basis, but is mediated by the social relations that predominate in society, and by the group behaviour of the population, in our case by its demographic behaviour.

The substance or content of demographic policy, we suggest, consists of three main trends:

1. its effect on social mobility, which consists in creating the most desirable societal structure by encouraging movement of population from one social group to another by various methods;

2. its effect on the natural replacement of generations, the character of which is determined by the intensity of the processes of natality and mortality (which determine changes in the size and the age and sex composition of the population); an increase in the number of births (above all of first births) linked with the effect of a population's age and sex structure must be distinguished from changes in the birth rate;

3. its influence on the shifting of people from one place to another, or migration (the migration policy implemented by the state is integrally linked with its policy in regard to territorial settlement of the population).

People's living and working conditions at the various stages of human history are directly determined by the mode of production. The basic economic law of a formation governs them, and reproduction, as well as the social problems that are resolved by revolution under the impact of objective conditions created by virtue of operation of the law of correspondence of the relations of production to the character of the productive forces.

The concrete individuals making up a population live and work in certain social conditions, and enter into numerous and varied relations with one another of an economic, political, national, religious, and family order.

The population, or the complex aggregate of people, is linked by many threads with society's social and political life. The level of the productive forces, the character of the development of the relations of production, and the degree of consciousness and organisation of the labouring people in antagonistic formations determine the degree and depth of the solution of the main population problems of their time, and the change in the workers' situation and their working and living conditions.

Social ownership of the means of production and planned development of the economy bring about something qualitatively new in population development, when broadening of the boundaries of free time (leisure) makes it possible to provide ever more favourable conditions for creative work, development of intellectual capabilities, and realisation of a full-blooded life. Only under socialism do both the theoretical and the practical conditions develop for harmonious combination of the interests of society as a whole and of the separate individuals, because both society and all its members have a single goal, namely the building of communism.

The social essence, methods of implementing, and the efficacy of demographic policy are determined by the effectiveness and direction of the state's socio-economic policy. The social system also predetermines the possibility of using this method or that in demographic policy. The regulation of demographic processes must not, of course, be understood as the development of some kind of obligatory "plan", expressed in certain systematic characteristics. That would not only contradict the essence of socialist democracy but would in fact be simply impossible. As regards natality and migration, however, it should be a matter of controlling the people's demographic behaviour, and of inculcating stable standards of demographic behaviour corresponding to the long-term interests of society.

All that requires the implementation of a broad complex of demographic policy measures, as well as a long time. That is why, in studying the possibilities of any one measure it is always necessary to remember that they must all be combined in a broad, continuous complex aimed, as a whole, at inculcating such standards of demographic behaviour as will correspond both to soci-

ety's long-term interests and to the aspirations of each separate family.

The methods of demographic policy can be conventionally broken down into three groups:

1) economic measures (family allowances; tax allowances for children; priority in the allocation of housing for families with a certain number of children; the provision of a system of nurseries and crèches, communal services and amenities, etc.); as regards migration, they involve the payment of various kinds of inducements to move in the directions needed by society, the establishing in "reception" areas of higher wage rates, accelerated development of housing and provision of amenities, and the provision of jobs for the "second" members of families (mainly women);

2) administrative and juridical measures (legislation permitting or banning the production and use of contraceptives; the minimum age of marriage, various privileges for fathers called up for military service); as regards migration, such legislation may prohibit or permit moving to one area of the country or another; and as regards social mobility, these measures may consist of various kinds of privileges for certain social groups in enrolment for study, in the distribution of social funds, and certain other acts on the same plane;

3) measures of socio-psychological effect consisting in using the mass media (press, radio, television) and all the forms of art in order to regulate demographic processes in the direction proposed by society, which is conditioned by the political, legal, and philosophical views dominant in it.

Administrative-juridical, and socio-psychological measures, it must be stressed, cannot give the desired effect in isolation from economic measures.

Much of the research into the effectiveness of the implementation of "family planning" programmes in certain countries indicates that no one measure by itself (e.g., family allowances) can solve the problem of regulating natality. It must therefore be a matter of a complex of mutually co-ordinated measures, which must above all include measures of an economic and administrative-legal character, as well as those of socio-psychological influence. The latter are organically linked with such a

very important sphere of the interests of demographers, sociologists, and lawyers, as the demographic behaviour of the population.

Not all the demographic sciences and spheres of socio-demographic activity mentioned have been sufficiently developed; but the fact of the existence of some, and of a need to develop the others, is obvious. It is difficult to exaggerate the role of demography and its constituent special sciences in the system of population sciences.

Demography is an independent social science whose place in the system of economic sciences, and of the social sciences in general, has still to be defined.

The process of deepening knowledge of population is undoubtedly made easier by the specialisation of demographers, geographers, economists and sociologists, and of representatives of other social sciences; but in addition to this process there is a hiving off of new branches of knowledge within such sciences as economics, sociology, ethnology, medicine, and genetics, each of which is also, in a certain sense, a synthetic, complex science. More and more often we are faced with the fact that one science or another proves to be on the boundary of two or more sciences. Thus ethnic demography, which is now taking shape, while part of ethnology is at the same time part of demography, especially of historical demography. This is where palaeodemography, too, essentially comes in, a trend of investigating population problems closely linked with archaeology and anthropology, each of which is also to some extent a synthetic, complex science; and so on.

Suffice it to say that many of the sciences studying population development patterns are not only already organically associated with the system of population sciences but cannot in practice develop without such links. The patterns of the natural replacement of generations, for example, cannot be explained either by the whole system of demographic sciences, let alone one of them, especially demographic statistics, but require the efforts of economists, sociologists, psychologists, ethnologists, lawyers, and many other specialists. The patterns of settlement studied by geographers cannot in fact be elucidated without demographers, or without ethnologists, lawyers, and people from several other sciences. The

science of population, as a system of scientific knowledge, is being developed in a process of mutual enrichment of contiguous sciences, in a process of the joint activity of scientists analysing socio-demographic processes and the people's working and living conditions.

The development of demographic studies as a system of sciences is a legitimate process of the transformation of demography into an independent social science with its own subject matter, into an aggregate of problems and tasks, theories and hypotheses, methods, and description of empirical data in the language proper to this science. Its development is an important condition for practical realisation of the requirements of the basic economic law of socialism.

7—0816

Chapter 2

POPULATION GEOGRAPHY

S. A. Kovalev, D. Sc. (Geog.)

One of the main tasks in geographical studies is regional analysis of the natural conditions, economy, and population in their interconnections, analysis of the areal dynamic systems arising as a result of these interconnections in various countries and regions and being historically altered through the effect of the development of social production and changes in socio-economic conditions.

Population functions as the most active component in these areal systems, being at once the chief productive force and the aggregate of consumers. Study of the location of industry, and of the industrial, territorial complexes formed by it, is particularly closely linked with study of the distribution of population, the composition and dynamics of the territorial groups of population taking shape at various populated points.

In Soviet geographical science population geography is therefore considered a necessary section of economic geography together with the geography of the economy.

In Western Europe, at the end of the nineteenth century,s pecial disciplines developed, viz., human geography and anthropogeography.

Methodologically speaking anthropogeography stemmed from a vulgar materialist conception of geographic determinism attempting to explain all the phenomena of the geography of population by the peculiari-

ties and effect of the natural environment. Its founder Friedrich Ratzel saw its task in explaining the influence of nature on the mind and body of individuals and nations. His methodologically unsound approach, which ignored the real laws of social development and distorted the problems of society's interconnections with nature, led to an extreme tendentiousness, an unscientific interpretation in anthropogeography of various demographic facts and of all the problems of the geography of population.

The other trend (human geography) arose in France. Its task consisted in studying the interconnections of nature and population in the concrete conditions of different countries and areas; it avoided the extremes of geographic determinism, but it was characteristically eclectic, its representatives basing themselves on the conceptions of bourgeois political economy and history. To explain the phenomena observed they put forward the most varied causes "on an equal footing"—natural economic, historical, psychological—and ignored the major role of the mode of production and the mediation of the effect of the natural environment through the economy. This school, which was founded by P.M.J. Vidal de la Blache, paid little attention to demographic analysis of population, and limited itself mainly to descriptive characterisations, occasionally vivid and interesting but more or less superficial.

In pre-revolutionary Russia geographical study of population had still not become a special branch of geography, although P. and V. Semenov-Tian-Shansky and A. Voyeikov had paid much attention to it in their work.

A Marxist dialectical approach to the study of social phenomena determines the main differences between Soviet population geography and bourgeois anthropogeography and human geography. This branch of research took shape in the 1940s and has been very actively developed. A leading role in establishing it has been played by N. Baransky, R. Kabo, Y. Saushkin, V. Pokshishevsky, O. Konstantinov, N. Lyalikov, and others.

Since the 1950s the separate branches or aspects of population geography in the USSR have attained different development levels according to the role of this or that problem in economic and cultural construction, the de-

velopment of "allied" sciences, and the quality of the necessary initial material. Quite a full idea of the range of themes of the research already being carried out on population geography can be obtained from the published papers of the three big interdepartmental conferences held on these problems on the initiative of the All-Union Geographical Society in 1962, 1967, and 1973, in which geographers, economists, demographers, ethnologists, and other scientists took part, and also workers from planning and design organisations.

The most widely developed field has been study of the geography of settlement (and resettlement), in particular the geography of towns. A settlement, urban or rural, is the "primary cell" of observations in population geography, the primary, most clearly defined territorial grouping of population. Hence the need for a typology of settlements (by functions, number of inhabitants, composition, dynamics of the population, origin, material forms, and conditions of development in relation to their economico-geographical location and economic functions), the need for distinguishing the characteristic features and peculiarities of the development of settlements of each type in various conditions. In that, of course, questions of principle are studied on the theoretical and practical plane, like evaluation of the economico-geographical location of populous points and its significance for their development in the past and present, the links between the functions and material forms of settlements, the composition and dynamics of their porulation, etc.

Such research brings geographical themes close to work in the field of areal planning, town-planning and building, the planning of rural inhabited points, and analysis of labour resources; more and more work is being done at the boundary where the geography of settlements overlaps with other sciences. That also applies to the study of small towns and their development problems, in which the geographic, demographic, and sociological and "planning" approaches are often combined, or to the study of urban agglomerations.

For all the significance of the comparative geographic study of separate typical or characteristic populated places (and of the separate parts of big cities, i.e., of the "inner geography" of towns), the main job is to analyse

settlement, i.e., the aggregate of populated places on a certain territory on which local systems of settlements have been formed with a definite structure, interconnections, and development problems. Such systems (from conurbations with their own specific features and problems to systems of towns of large economic areas or regions) and the division of functions in them, are studied in close connection with the economy of the area and the development and distribution of its productive forces.

Geographic study of settlement is part of study of the territorial organisation of the productive forces. It is linked areawise with problems of long-term planning of the economy, and with economic regionalisation and regional planning.

In such research a limited range of demographic data is usually employed. The work, it seems, presents less interest to demographers than the geographical characteristics of the "primary cells" of settlement—individual populous points and their various types (small town, medium-sized town, large and very large cities, rural settlements—the centres of state farms and collective farms, district centres, etc.). In the latter case geographers endeavour to employ the most detailed demographic data, sometimes independently processing initial documentation on population or collecting basic data by research, work that gives a fuller picture of the local conditions affecting the demographic processes in settlements of various kinds.

Most work is devoted separately either to urban or to rural settlement, which has its own specific features. In geographic study of rural settlement attention mainly centres, of course, on discovering its links with a certain organisation and specialisation of agriculture, with the special features of making use of the area for farming needs. It calls for distinguishing and considering various "types of intra-farm settlement" on collective and state farms, their limitations, advantages, and drawbacks from the angle of farming needs and the rural population's living conditions.

In addition, a regular trend has been noted toward integrated research into settlement as a whole (both urban and rural, and their interconnections) for a certain

area, which is mainly carried out in regard to conurbations and the suburban zones of cities.

In recent years mathematical methods of research have begun to be applied in Soviet population geography, as in other countries, especially to the study of populated areas and their networks, which makes it objectively possible to establish or check a number of patterns and links between phenomena, to make a multifactor analysis, and to model complex areal structures and their dynamics.

Modern economic geography pays much attention to studying the "population-area" relationship, and the corresponding problems of population density, migration, areal differences of structure and indices of the reproduction of the population.

In comparative analysis of the density of a population and its distribution over the area of a country, the first step is to "establish the facts", i.e., to obtain from the available demographic statistics the most detailed picture of the distribution and density of the population, and of the changes in this picture over a certain period. This gives the basis for breaking the areadown into regions according to certain attributes, and for distinguishing certain "density types" (correlated with various types of economic use of the area). The causes of the changes observed in the distribution and density of the population can thus be clarified, for which the development of social production and the distribution and use of manpower are analysed area by area.

Shifts in the distribution of population in the USSR in various periods have been identified and examined in several publications. Regional differences in the composition and use of manpower resources are still those least studied by geographers, although there has been some research in this field too (most of it unpublished).

Much attention has been paid in recent years to studying migration, its scale and directions in various periods, the results of inter-regional migration links (the migration balance) and their results in the sense of the rooting or "settling down" of the immigrants in the new places; study of the factors affecting the population's migratory mobility, and the effect of migration on the area dynamics of the size and composition of the popula-

tion. Migration problems are among the most complicated questions of population, and call, more than others, for the joint work of scientists of various specialities.

Regional differences in the composition and natural movement of the population have been less studied in an integrated way.

This obvious gap must be filled, of course, by complex regional characteristics of population and inhabited points. It would be wrong to suggest that the writing of regional monographs on population is "description" and "factography". "Such an attitude to such work would only have been justified when population geography was finding its feet and its methods had not yet reached the level of development needed to disclose the causal dependence of the various kinds of phenomenon. Now, when much has already been done in this direction, the complex characteristics of population must be compiled on another basis, by analysing the interconnections of the separate elements rather than the elements themselves."[1]

One may note the successful experience of compiling such characteristics for territorial groups of population of different size. As an example of the detailed geographical characterisation of the population of a whole republic we may cite Jaoshvili's monograph on the population of Georgia.[2] The work of many other researchers devoted to small areas is also of interest.

The mapping of population is a special field and has a leading place in both the technique and the practice of cartography. There are a number of population maps in the large regional atlases published in recent years in the USSR, and also in the capital *Atlas of the Peoples of the World*. After the 1959 census detailed maps of the population density of the USSR were compiled under the direction of V. Korovitsyn, and maps of the development of the network of urban settlements between

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[1] D. I. Valentey, N. Y. Kovalskaya. The Place of Population Geography in the System of Population Sciences, *Nauchniye problemy geografii naseleniya* (Scientific Problems of Population Geography), Moscow, 1967, p. 33.

[2] See V. Sh. Jaoshvili. *Naseleniye Gruzii. Ekonomiko-geograficheskoye issledovaniye* (The Population of Georgia), Tbilisi, 1968; A. A. Chernoyarova. *Muyskaya dolina (priroda, lyudi, khozyaistvo)* (The Muy Valley: Nature, People, Economy), Ulan-Ude, 1966; and others.

1926 and 1959. The demographic characteristics of the population (e.g., collation maps of the differences in age composition and natural movement of the population, and so on) constitute an integral part of the general set of population maps.

Population geography themes are now included to one degree or another in the work programmes of many expeditions, which usually have a chance to process valuable primary material (the household records of rural Soviets; the card indices of the personnel departments of enterprises; address lists of the present and former population; the data of questionnaires, and so on). Favourable opportunities are provided by expeditions for carrying out simultaneous geographic, demographic, and sociological observations and for joint work by the corresponding specialists.

In other countries research in population geography has been differentiated since the 1950s. Specialised work predominates in it; various mathematical methods of analysing settlement and the areal distribution of population are being increasingly utilised, which calls for broad use of numerical indices (including demographic ones). "Urban geography" has grown into a special, very ramified field.

From the methodological angle modern population geography in capitalist countries eclectically employs the various historical, economic, and demographic conceptions circulating in bourgeois countries (of the various demographic conceptions, optimum theory most attracts the "sympathies" of geographers). This fragmentation of population geography into a number of quite isolated branches and the predominance of narrowly specialised research have weakened attention to general methodological questions. Geographic determinism is not now characteristic of bourgeois population geography, although echoes of it can still be found in some works. Anthropogeography and human geography as definite schools in geography have relegated to the past without being replaced by other more or less balanced systems of views.

In the socialist countries, where population geography began to develop along new lines after World War II and the establishment of the new social system, scientists

are basing their research on the Marxist-Leninist doctrine of social development. In most of these countries study of population geography has a leading place in geographical science.

What place does Soviet population geography occupy in the system of sciences studying population?

We share the view of those workers who consider there to be a special group of sciences among those studying population, a group investigating the distribution patterns of various separate criteria (or their combinations) characterising a population in its life conditions. The main job of these sciences "is to analyse the complex interrelations of population and territory. Population geography concerns itself with this problem in the broadest, most all-round way."[1] The analytical sections of population geography "studying phenomena of a single order, for example the forms of rural settlement or the geography of commuting, the geography of manpower reserves ... disclose the development and distribution patterns inherent in these phenomena in all their connections and mediations. Thus a system of concepts, indices, scientific factors, and propositions is built up that is the foundation for generalisations in the synthetic sections, the task of which is to characterise the population of a given area in an all-round way as a single whole."[2]

There remains the question, however, of how far a complex characterisation of the population of a certain area is the job of population geography and not of regional demography, which has a quite legitimate right to exist. Let us consider, in this connection, how the job of geography in population study is understood by our colleagues in other socialist countries.

The well-known Polish geographer Stanislaw Leszczycki defines the basic aspects of "the scientific interests of geography" as the areal differentiation of phenomena, as the identification of the special features of an area distinguishing it from other areas, and as the bringing out of the connections between the phenomena in a given area, especially the "man-geographical medium" as-

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[1] D. I. Valentey and N. Y. Kovalskaya. *Op. cit.*, pp. 28-29.
[2] *Ibid.*, p. 31.

pect. The latter he considers to be the most important aspect.[1]

In fact, these three aspects can be found in varying ratios in most research in population geography. The first is not the "monopoly" of geography or its specific features (regional differences in the birth rate, the age structure of the population, density, etc.), but provides the requisite premises for the other two when one is identifying the set of attributes specific to a given area, and its dependence on certain causes and relations.

The Hungarian geographer János Kolta considers that population geography should, strictly speaking, study not population itself but the interconnections existing between demographic, physico-geographical, and economico-geographical processes and phenomena.[2] Hence it follows that making use of the work of demographers does not remove the need for independent geographic analysis of the demographic data. One cannot, however, agree with Kolta when he obliterates, as it were, the material object of the research (territorial groups of population).

For a comparative characterisation of territorial population groups and indentification of the linkages within complicated regional complexes of the productive forces, including population, geography requires the most detailed possible, varied data of demographic statistics (census data, current estimates, and selective population studies) on territorial units, down to separate populated points as geographers' primary units of observation. The possibilities and depth of the analysis of linkages, and of the influence of local factors on the composition and movement of population, greatly depend on the degree of territorial differentiation of the population data, which is of great theoretical and practical significance both for geographers and for demographers.

In their research geographers must take into account the population laws proper to each social formation, the general patterns of reproduction and structure of the pop-

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[1] S. Leszczycki. Current Problems of Economic Geography, *Przeglad geograficzny*, No. 4, 1966.

[2] J. Kolta. A népességföldrajz targya módszere és helye a földrajztudomanyok rendszerbén, *Dunántúli tubomanyos gyüjtemeny*, No. 40, 1963.

ulation, and the links between demographic indices, and must to some extent employ the methods of analysing populations and their movement developed by demographers. Geographers need to have a quite high level of "demographic literacy", the more so since there are forms and degrees of research that can be carried out in almost equal degree by either geographers or demographers with sufficiently broad training. Thus work may include the discovery and mapping of regional differences in individual demographic indices (natality, mortality, sex and age composition, etc.) and breaking an area down into subdivisions according to these indices (or their combinations).

Demographers in turn also need to master geographic methods of research, and in particular to know and widely apply cartographic methods of representing and analysing the facts.

The collection and processing of a certain range of demographic facts for small areas and separate populous points by means of field investigations, and drawing on primary data and information from questionnaires, can also obviously be done either by demographers or by geographers, given co-ordinated programmes. In such cases research is specialised mainly in the final stages, in the utilisation and analysis of the observations obtained at the level either of regional demography or of population geography.

The main and most specific job of geographers is to study the connections between the natural environment, the economy, and the population in the concrete conditions of a certain area with a varying degree of economic development and settlement. Only such an analysis enables us fully to understand the effect of the many local conditions (of the complex of local conditions and its components) on the various aspects of the population's life, composition, and movement. Demographers are also interested in geographers' development of such research.

So far, unfortunately, this kind of "feedback" between population geography and demography is still weakly developed. But it will, undoubtedly, be mutually beneficial. With the development of these sciences within a system of population studies, the connections between them will clearly be strengthened and broadened.

Chapter 3

ETHNICAL DEMOGRAPHY

V. I. Kozlov, D. Sc. (Hist.)

The links between demography and ethnology, at least in Soviet science, can now be considered fairly recognised.

Ethnology is accepted as part of the system of historical sciences, but it occupies a special place among them as regards both its object of study and subject matter and the methods it employs (e.g., the method of direct "field observation"). Its job is to study the origin of the nations and peoples of the world, their historical development and interconnections, material and spiritual culture, traditional ways of life, and other general and specific elements of their life; in recent years more and more attention is being paid to processes leading to changes in ethnic characteristics and attributes, and to ethnic affiliation itself.

The basic object of ethnology is nations or peoples (*ethnoi* or "ethnic communities"), which are one of the most natural and stable forms of social grouping of people. It is no accident that *ethnoi* in their various forms (from tribes to nations) have played a leading role in the history of human society, yielding place in this respect (and then not always) only to class and state communities. The national question was and remains one of the fundamental, and at the same time one of the most acute and complicated problems of the social, economic, and cultural development of multinational states. In many

ways it also determines special features in the political intercourse of certain countries.

All-round investigation of national phenomena includes, as one of its most important aspects, detailed analysis of the numerical size of peoples, quantitative characteristics of the national (ethnic) composition of the population of countries, and their changes in time. It is indicative that Lenin, in stressing the paramount role of statistics in the study of social phenomena, had in mind above all precisely information on the national composition of countries' populations.[1]

Quantitative indices are also of great value in ethnology. The size of the objects being investigated (primarily of nations), and the spread of language and culture, are determined by means of them, and certain differences established in the evolution and development of both large and small ethnic communities. Quantitative criteria are essential in the typology of ethnic communities. They are used, in particular, to distinguish so-called national minorities, and to help to distinguish a type of *ethnos* like a nation from the tribal and other ethnic formations that preceded it. The interaction of peoples and the development of ethnic processes due to it are also mainly governed by the numerical ratio of the contacting groups.

Responding to scientific and practical needs, the population statistics of many countries have long since included among their tasks determination of the national (ethnic) and language composition of the population and the numbers of the separate nations or peoples. As research in important population problems has developed (primarily those associated with the dynamics of natality) demographers have found it necessary to take into account a number of factors associated with culture, way of life, traditional behaviour, and other aspects of life studied chiefly by ethnographers. The stability of ethnic communities compared, for example, with professional and other groupings, and their great significance in social, cultural, and other relations, has necessitated the wide use in demography of an indicator of national (eth-

[1] See V. I. Lenin. Statistics and Sociology, *Collected Works*, Vol. 23, pp. 271-77.

nic) affiliation. Grouping by nationality, in combination with indices of natural population movement (natality, mortality, etc.) and with other demographic characteristics, enables us to bring out certain important patterns, and sometimes to create a sounder basis for demographic forecasts than the grouping by administrative areas usually employed. Thus demographers are moving, as it were, toward ethnography.

The successful development of links between demography and ethnography is expressed, in particular, in the rise at their boundary of a specific scientific discipline, ethnic demography. Initially it aimed mainly at helping along ethnological (and social-historical) research. Its task therefore first of all consisted in establishing the national (ethnic) composition of one region of the world or another, determining the numbers of peoples and of various ethnographic (and religious and racial) groups, studying the dynamics of the national make-up of countries and the size of individual nations during their historical development. Later its scope was broadened to embrace analysis of the main demographic indices (of natality, mortality, nuptiality, etc.) and of demographic processes from the ethnic aspect, and to establishing the links between these indices and specific features of culture, way of life, and traditions in the life of the world's peoples.

The interaction of ethnography and demography (or rather of the aspects of the latter associated directly with population statistics) in problems of determining the size of separate nations or the ethnic composition of the population of some one country or region of the world is quite obvious. Nations (*ethnoi*) are very complex social formations, especially in developed class formations, and each of them has a host of individual features that greatly complicate the development of a general scientific definition of "nation", and the establishing of its main attri-

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[1] In our view the main attributes of an *ethnos* are the following: ethnic self-awareness, in which an important part is played by the idea of some kind of community of origin, native language, territory, and peculiarities of culture and way of life; to these are often added (as a feature of the national stage of development of an *ethnos*) the existence of a social-territorial (or state) organisation, or a striving to attain such an organisation.

butes.[1] Anyone who is little acquainted with ethnic problems may easily identify an ethnic community with a racial, religious, or, for example, a state community, or may take some part of a nation (ethnographic group) for an independent nation, and so on. It is ethnology therefore that really gives demographic statistics the scientific tools needed to take national (ethnic) structure into account in censuses and other forms of mass counting of population, and provides the basis for processing demographic data.

Ethnologists play a leading role in determining the ethnic composition of foreign countries. They are developing the methodological basis for analysing and correcting the ethno-statistical data of the censuses of those countries, and the basis for employing various indices (including indirect ones) on religion, citizenship, etc., literary and cartographic sources, and so on. It is also their job to develop the problem of the correlation of the indicator of national (ethnic) affiliation (which, in scientifically organised statistics, as in the USSR, is considered the main ethnic determinant) and the indicator of language (mother tongue, main spoken language) often met in censuses.[1]

Much more complicated, but no less organic, is the interaction of ethnology and demography in the other problems of ethnic demography enumerated above. A central place among them is taken by problems associated with study of the dynamics of world population, which is determined by two main groups of factors. One of these groups embraces features of the natural movement of the population (above all the ratio of births and deaths specific to any particular *ethnos*), while the other group covers the ethnic processes (i.e., processes of the differentiation and merging of nations or of their separate parts). We shall limit ourselves to considering the round of problems associated with analysing the factors of natural population movement.

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[1] Among the works devoted to this theme, we must note the capital work *Chislennost i rasseleniye narodov mira* (Numbers and Distribution of the Peoples of the World), Moscow), 1962, which reviewed the methodology of determining a detailed characterisation of the national structure of all countries of the world, and gave such a detailed characteristic for all countries, and the numbers and distribution of around 900 peoples.

Investigation of the reproduction indices of a population, and of the factors determining them, is a main task of demography; but many of the problems in this field are still poorly developed. Among them is the complex of questions associated with clarifying the ethnic aspects of reproduction, and the specific features of natality and mortality among various peoples. The available data indicate that the levels of the birth and death rates, and the natural population growth (or decrease) determined by their difference, undergo great variations both during the historical process at various stages of social, economic, and cultural evolution, and in each concrete epoch (socio-economic formation) among peoples living in different countries and within one country or another. Thus the indices of natural growth of the indigenous peoples of the Central Asian republics of the USSR are over five times the corresponding ones for the Baltic peoples.

The birth rate or fertility of concrete populations is moulded in the main by the impact of socio-economic and psychological factors (both individual and social) closely linked with the features of their culture and way of life. The effect of psychological factors on fertility, it must be stressed (despite their ultimately derivative character), often proves more appreciable than the impact of socio-economic factors (it is not out of place to note here that the influence of these factors too can only make itself felt through the consciousness of people). Natality and fertility are directly associated with the conscious desire (or reluctance) of married couples to have children. The availability and efficiency of contraceptives is of no little importance, of course, in possible limitation of the number of children in a family; but the role of this factor should not be exaggerated. The low dissemination of contraceptives long known in the past, and the failure of the introduction of modern means of birth control in certain developing countries is to be explained by the countereffect of the social guidelines and traditions of fertility, and by a certain social psychological atmosphere that creates obstacles to such control. A leading role in creating such an atmosphere, especially in the past, has been played by the religious factor.

National (ethnic) affiliation, i.e., people's membership of a certain nation, included by some researchers

among the basic factors in natality, does not itself (at least in modern times) directly affect the birth rate, although its indirect influence, for example when a nation has its own state and that state pursues a special population policy, is quite often encountered. National awareness or consciousness, a feeling of belonging to a certain nation or people, may manifest itself in the form of concern for the natural perpetuation of that people by active involvement in child-bearing. But such motives do not generally arise spontaneously in the demographic behaviour of married couples but through the appropriate national (or national-state) propaganda.

That does not mean that there is, in general, no ethnic aspect of natality; it is simply that national affiliation in itself does not provide the answer to why a group of people of a certain nationality has such and such a birth rate and not some other. The ethnic aspect of natality arises through the effect of a whole series of factors associated with features of a particular nation's economic activity, and the forms of social and family organisation, culture, way of life, traditions and guidelines common among the people that influence the demographic behaviour of this national group.

In addition, we must note that ethno-differentiating factors may have less effect on the birth rate than other factors, which leads, on the one hand, to wide variations of birth rates within one and the same nation, and, on the other hand, to great similarity in birth rates between different nations. In the USSR, for example, the present picture of the differentiation of the birth rate over the country does not coincide with the boundaries of the different nations. If we take the republics of Central Asia, Kazakhstan, and Azerbaijan, which stand out quite clearly as regards their demographic indices, we find that all the indigenous populations, irrespective of whether they are Turkmenians, Uzbeks, or say, Azerbaijanians, have similar high birth rates. The role of nationality here, as in several other parts of the world, incidentally, is clearly relegated to a secondary plane behind certain survivals of religious attitudes preserved in the way of life (in this case the maxims of Islam). Standard of education, the jobs of the population, and other factors also have a strong impact on natality.

It is advisable to begin a survey of the cultural, habitual, and psychological factors in natality with the traditional attitude to marriage and the age of marriage. The high natality now observed among many nations, especially in developing countries, is associated (to a considerable extent) with the traditions customary in them of early marriage, when girls tend to be married off almost as soon as they reach puberty. Early marriage can have a deleterious effect on the health of women; at the same time it can raise fertility substantially because of the longer time they have marital sexual relations. Traditions of early marriage are usually combined with maximum involvement of all women of child-bearing age in marital sexual relations. Unmarried women are seldom encountered in these countries, and then mainly in connection with religious dogmas.

The main cell in reproduction of the population is the family, there being a certain connection between the forms of family organisation and the birth rate. The high marriage and birth rates among a number of nations are undoubtedly due to such phenomena as the prevalence among them of clan or undivided ("big") patriarchal families, the members of which help one another in household and economic matters, in looking after the children, and so on. The reduction of natality in many economically developed countries, for example, has been associated with a decline in the traditions of the big family, with the "autonomisation" of married couples under the impact of urbanisation, spread of education, and other causes. In speaking of the demographic effect of the forms of family organisation, one must note the ambivalent significance of polygamy in the nations practising it; it lowers fertility, on the one hand, but, on the other hand, may raise the marriage rate and general birth rate (especially with a marked diminution in the number of males).

Traditions of having many children are a very essential factor affecting natality. These traditions began back in primitive society as a normal reaction to the very high mortality existing then. Many of them were preserved and developed further in early class formations. In most of the nations of the world children are one of the highest social values; the childless family evokes pity and

censure. Among the important incentives to having many children, especially among the peoples of developing countries, is high infant mortality, and the fear associated with it that with a small number of children not one of them will survive to maturity and be able to take care of the parents in old age. Among peoples with a patrilinear system of kinship great significance is attached to the birth of sons as continuers of the clan and of the family name.

The tenacity of this tradition among many nations is reinforced by the attitudes of religious systems; religions often exert their influence on the birth rate through maxims determining the age of marriage and nuptiality, the forms of the family and of marital relations between spouses, and so on. Without going into all aspects of this problem, let us note that of the four so-called world religions, Buddhism, Christianity, Hinduism, and Islam, the last two undoubtedly have a positive effect on fertility. The influence of Buddhism and Christianity in this respect is not so marked. Their main branches, as a rule, on the one hand, condemn the use of contraceptives, thus encouraging high fertility, but, on the other hand, appeal for "mortification of the flesh", celibacy (monasticism), and so on.

The birth rate is also affected by the social position of women. Women are more interested in birth control than men since only a reduction in the number of children usually enables them to break out of the narrow round of family and domestic interests, and to attain equality with men in social and industrial fields. The unequal social and family position of women, due to surviving patriarchal traditions, customs, and beliefs (and nearly all religions, especially Islam and Hinduism, preach the inferiority of women), is therefore undoubtedly an obstacle to birth control, and encourages the maintenance of high fertility.

Passing now to an analysis of mortality, let us note that the advances made in combating its various causes (especially diseases), and the lowering of the death rate in former colonial and backward countries almost to the level of the economically advanced countries, have tended to push this analysis into the background compared with research into natality. Yet this aspect of reproduction also

deserves close attention. Analysis of the dynamics of mortality has particularly great significance for historico-demographic research because, for thousands of years, right down to the twentieth century in fact, it has been mortality that has determined the main differences in reproduction and features of the changes in numbers of most of the world's peoples. It is indicative that the first research work in Russian literature on the ethnic aspect of the country's natural population movement was devoted to an analysis of differences in mortality.[1]

In reviewing natality factors we did not touch on biological (including racial or anthropological) differences, whose influence on the birth rate is, on the whole, small; as for mortality, however, they play a marked role. The people who form *ethnoi* have lived for thousands of years in certain natural conditions and have become biologically adapted to them, which has found reflection in the evolution and consolidation of racial variants. The dark skin of negroids, as is known, protects them against the harmful effects of the ultra-violet part of solar rays; cancer of the skin, which is quite common in tropical countries, mainly affects Europeans who have settled there in natural conditions to which they are not accustomed. At the same time the higher morbidity of the Negro population in countries with a temperate climate is associated to a considerable extent with certain anthropological features peculiar to them (broad noses and nostrils), which make for better heat regulation in the tropics but for a higher rate of illnesses of the respiratory tract in below-freezing temperatures.

Something must also be said about the existence of certain genetic, i.e., hereditary, diseases that may, because of the tendency everywhere toward ethnically homogeneous marriages, acquire an ethnic aspect.

The ethnic aspect of mortality operates quite appreciably in wars, which have often, by the way, had a very strong impact on the whole course of the natural reproduction of many countries. This was manifested particularly clearly in the primitive communal age and in

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[1] See M. V. Ptukha. *Smertnost 11 narodnostei Rossii v kontse XIX v* (Mortality of Eleven Nationalities in Russia at the End of the Nineteenth Century), Kiev, 1928.

early class formations, in which armed clashes between separate tribes and peoples prevailed. Many of the wars of modern and recent times, e.g., the wars between national states, wars of national liberation, and a number of colonial wars, have had a nationally selective character. If we take the two world wars, their impact on the dynamics of the size of the nations involved was far from the same: the relative and absolute losses of the Dutch, for example, were much lower during World War II than those of the Byelorussians, who were roughly equal to them in numbers.

The losses suffered by several nations as a result of the operation of a policy of genocide against them have been close to war losses in their violent character.

Various national traditions and customs exert a marked effect on the death rate, and on its sex and age variations. Thus the numerical predominance of males observed in several Asian countries at the present time (India, Pakistan, Indonesia, China, etc.) is primarily explained by a traditional scornful attitude to females. Daughters, as a rule, were less well cared for after birth, and were dressed and fed less well; doctors were called in less often in cases of illness, and so on. All that, plus heavy toil, early marriage, and frequent pregnancies and deliveries led to a higher mortality among females in almost all age groups.

Customs linked with pregnancy and childbirth have a considerable effect on infant mortality, e.g., traditional methods of delivery, care of the newborn, etc. Among the Caribs (South America), for example, pregnant women are forbidden to eat eggs, manioc bread, green bananas, and large fish because these foods allegedly hinder development of the foetus. Among the Malays pregnant and nursing women are forbidden to consume vegetables and fruit, which are seldom eaten as it is. This leads to a deficiency of vitamin C in the organisms of mother and child.

Customs linked with the feeding of children have a great effect on their health, especially breast feeding duration, which varies from six months to three years or more among different peoples according to domestic traditions. On the whole breast feeding is known to have a favourable effect on the health of babies.

Mortality also depends to a certain extent on the features of nutrition in subsequent age groups; traditional rules for feeding play no small part in the development of a whole number of diseases. Food traditions and customary ways of preparing dishes are in fact so stable among many peoples that even in conditions of malnutrition people may refuse new and better foods in favour of traditional dishes (in India, for example, many people still refuse to eat meat), or may use methods of cooking that greatly reduce their nutritive value.

The use of various stimulants has a marked effect on morbidity and mortality, in particular, consumption of alcoholic beverages, the traditional types of which vary widely among different peoples, as does also the extent to which they are used.

Stimulants of a non-food origin are extremely varied and very widely used, especially various forms of smoking (from comparatively weak tobacco to such strong narcotics as opium). The harmful effect on the nervous system is intensified by their unfavourable action on the other organs of the body, and, in addition, by the carcinogenic properties of many of them. Medical research has established, for example, that smoking tobacco often leads to cancer of the lungs, mouth, or nasopharynx. It has been found from studies of these ailments in India that people are especially liable to them who keep to the traditional ways of smoking (the *kalian* or Persian hookah; smoking with the lighted end in the mouth, and so on. The chewing of betel, which is used as a rule mixed with lime, and of oral irritants like Central Asian *nas* (a mixture of tobacco, ashes, lime, and cottonseed oil), often leads to cancer of the mouth and oesophagus.

The existence of various religious rites and rules (baptism and communion among Christians, ablutions and pilgrimages to holy places among Muslims, etc.) is often a cause of the spread of epidemic diseases. The comparatively few rational religious customs, e.g., the inclusion of cleanliness by Islam among the five deeds "pleasing to Allah", are pushed into the background by a mass of harmful rites and injunctions, e.g., Islam's exhausting fasting, food regulations, physical mortification, and so on.

Our survey of the cases when workers studying demographic variations must turn to ethnographic data could

be considerably extended and supplemented, in addition, by cases when ethnographers could profitably resort to demographic data in their studies. But it will be quite clear, without that, that further development of ethnic demography will help in many ways to promote complex study of the problems of world population.

Chapter 4

SOCIOLOGICAL ASPECTS OF DEMOGRAPHIC BEHAVIOUR

V. A. Sysenko, Cand. Sc. (Philos.)

Study of the structure and substance of a population's demographic behaviour, i.e., of the behaviour in which the diverse social factors affecting the processes of reproduction manifest themselves, is of great significance in the investigation of many population problems.

Demographic processes are part of social processes, and the demographic situation at any period of time is built up from a mass of individual acts in which the active, conscious will of each person manifests itself.

Every individual can marry early or consciously postpone the event. Young couples may decide to have their first child soon after marrying or may postpone the event indefinitely. Depending on their plans for life, and their intentions, interests, and needs, couples may have two, three, four, or more children, or maybe just one. All that affects the course of the demographic processes in a country as a whole and its separate areas.

If these processes are only investigated by traditional methods, people's conscious activity remains unstudied. For that reason a number of demographers in the USSR and other countries have moved forward in recent years and endeavoured to analyse the social and economic factors affecting the course of demographic processes. It has become necessary to unravel the mechanism of how various factors (socio-economic, legal, and ideological) are refracted in the consciousness of the separate indi-

vidual and take shape in that person's definite socio-demographic behaviour. One path of demographic analysis could obviously be a theoretical and practical investigation of the socio-demographic aspects of a human being's behaviour. In studying them one would undoubtedly have to remember that various needs underlie this behaviour, needs that include all aspects of life activity and are characterised by physiological, psychological, economic, and social qualities and attributes.

Man is linked with his environment through a system of wants. In a certain sense people's attitudes to social reality and to each other are manifested through this system. A person's behaviour actualises the linkage between his or her conscious needs and the environment, and his or her dependence on that environment. Furthermore, people master and control the objective world by satisfying this system of wants. As a result of this always active process man expresses his human nature and develops his capabilities.

By engendering various spheres of social production and culture human activity also creates corresponding needs for its goods. Satisfaction of man's needs can therefore be considered a kind of necessary mastering of human culture. The satisfying of material and intellectual needs is a *sine qua non* of the development of the human personality, of a person's creative potentialities and capabilities. And if a person is forced to struggle to satisfy his or her most pressing needs, that can have a negative effect on the development of his or her intellectual needs, and consequently also on his or her capabilities.

An important feature of wants is their capacity to be transformed into a whole number of psychological phenomena: urges, desires, emotions, interests, motives, guidelines. It is therefore not fortuitous that most psychologists consider need a fundamental category.

Human behaviour, one may say, is directed to the maximum satisfaction of material and intellectual needs possible in any given conditions of the social environment. In considering the interrelations of personality and the social milieu, it is necessary to distinguish the moment that the individual's behaviour is directed at co-ordinating his or her own personal aims and interests with the aims of the collective, social group, or other

social community of some sort to which he or she belongs. Man has to agree, correlate, and control his behaviour with other people in the sphere of productive or non-productive intercourse. He is also forced to adjust his behaviour to the moral standards, customs, traditions, and values that exist in society. That does not negate his activity, which is associated with his constant efforts to satisfy his wants. Forms of behaviour may be altered in accordance with man's broadening needs and with changes taking place in the social environment.

Forms of behaviour, while correlated with the real life situation, depend at the same time on man's seeking the best variant for tackling the life problems facing him. Thus one type or another of an individual's behaviour is the form of his or her attitude to the conditions of the social milieu and the corresponding system of reactions to its demands. People are guided in their actions, on the one hand, by wishes, motives, interests, and inclinations that have arisen from their natural and higher material needs, and, on the other hand, by ideals, cultural values, ideas, and moral categories, i.e., by everything that has matured and developed through education and ideological influences, from their spiritual needs.

The features of behaviour we have recalled here also apply to man's demographic behaviour. Demographic behaviour is part of the individual's whole socio-psychological behaviour, which has a decisive effect on the possibility of some demographic event or another happening.

Demographic behaviour can obviously include the motives and psychological guidelines that determine the decisions taken by the individual in regard to marrying, breaking up a marriage, having an abortion, or having a first, second, third, or fourth child, moving to a new place of residence, and so on. The aggregate demographic behaviour of a population, built up from individual acts, will determine the intensity (whatever it is) at which demographic processes take place.

Analysis of the demographic behaviour of separate individuals consists in establishing the general uniform elements composing it, and the linkages between them. One of the main jobs in investigating demographic behaviour therefore is to distinguish certain common moments

and patterns, and in particular the typical forms of people's behaviour. These types of demographic behaviour should be distinguished by eliminating diversity, by substantiated reduction of them to a small number of selected types.

In analysing a population's aggregate demographic behaviour, one describes it on the basis of one essential criterion (e.g., the number of children in the family).

What are the premises for distinguishing common elements in a population's demographic behaviour?

(1) One can distinguish common features in the needs underlying people's behaviour, because (in spite of their variety) they are objectively conditioned by the level of development of social production.

(2) The socio-economic situation of the various social groups to which the individual belongs has a certain stability and many similar common features in level and distribution of income, and also similar common features in the allocation of non-working time and leisure.

(3) The common features in a population's behaviour are also caused by the fact that individual people are faced with the same or similar tasks in meeting their needs in a quite similar situation.

(4) The possibility of distinguishing common types of demographic behaviour is confirmed by reality itself, which indicates that people act in the same way in many situations. Thousands of families, for example, have two children, and only two. As we see, here we have a result of demographic behaviour that is distinguished, as regards thousands of people, by constancy. Consequently we can suppose that there is a pattern of some kind of common causes and factors behind an identical end result of demographic behaviour. Furthermore, there is a common motivation, a common guideline with a large number of people. The problem consists in understanding the inner organisation of the individual that leads thousands of people to a decision of the same type.

It is very important to answer several other questions. What factors affect the formation of this behaviour? Along what lines does its development proceed? What are its principal stages? Why, in spite of the vast differences between human personalities, do we observe fairly rigidly determined types of demographic behaviour? It

is very important to trace how demographic behaviour of a certain type is distributed in any one social group.

In investigating the socio-demographic aspects of human behaviour, one can, apparently, take the concept of a social guideline as the main, key concept. One interpretation or another of this concept often depends on what the field is, in which an author is working, that provides him with some or other definition of the concept. Workers concerned with general psychology, we may say, rather restrict the concept, while social psychologists, on the contrary, extend its limits. In contrast to them sociologists also broaden the meaningful characteristic of the concept and invest it with a rather altered sense. This phenomenon probably has a certain pattern to it, since it broadens the sphere of application of the concept of a guideline; but one can also notice something in common in the different definitions.

In the view of D. N. Uznadze and his followers, behaviour as a special example of organised activity directed to attaining certain aims does not arise directly from needs, but is "preceded by the altered psychological state of the subject, which, like the state of readiness for necessary actions, is prompted by the effect of an objective situation and mediates the performance of behaviour....

"According to the principal, basic postulate of guideline theory, things look as follows: there is no activity without needs and an environment that includes objects satisfying them; they are the conditions for the rise of any behaviour. They do not, however, engender it directly but through a guideline, i.e., there first arises in the subject experiencing some need a guideline for the appropriate behaviour in response to the effect of the environment; and then on its basis the behaviour itself is performed that is the means (and occasionally also the object) of satisfying this need."[1]

Soviet researchers have as yet done little in the field of social guidelines. Several sociologists (e.g., V. S. Komarovsky and V. V. Vodzinskaya), it is true, have turned to investigating them in recent years, and on that basis one may give an approximate definition of this concept.

[1] Z. I. Hojava. *Problemy navyka v psikhologii* (Problems of Habit in Psychology), Tbilisi, 1960, pp. 181-83.

In our view social guidelines synthesise the individual's life experience and mental world to a certain extent. They are a form of generalisation in the individual's consciousness of his or her knowledge of the external world and are created as a result of very complicated conscious or unconscious analytico-synthetic activity.

Social guidelines determine the direction of an individual's activity, which is expressed in a task of some sort being performed from a definite position, which then influences all the individual's subsequent behaviour. In a certain sense social guidelines function as generalised programmes for behaviour in typical or similar situations, and are an intermediate link between some one effect of the social environment and the individual's reaction to it.

The concept of social guideline has the advantage that it links the individual's needs, interests, and motives, and the real life situation into a single whole. The concept does not separate the two components, i.e., the individual's activity and the social environment in which his or her life activity takes place. It provides an opportunity of considering the individual as the actively operating subject of social practice. Thanks to social guidelines human behaviour is not a bizarre game of feelings and emotions and passing wishes, but acquires orderliness and stability.

The study of social guidelines therefore presents a chance of forecasting the behaviour of definite social groups, since guideline is one of the main links in this behaviour. Belonging to the individual's inner world, social guideline is the hidden variable that can be employed to describe the co-ordination and similarity of the reactions of individuals to a certain class of stimuli in the social environment.

Everything we have said above about guidelines in general applies equally to demographic guidelines. As regards their content, the latter are linked in the closest way with the question of what is significant for a person in the world, what is the meaning of his or her life and activity. They are part of the individual's social guidelines and occupy a special position in the structure of a person's behaviour. Thus demographic guidelines, having as their basis a person's system of material and

intellectual needs and values, express the sense of purpose of demographic behaviour, the person's readiness to act in a certain way rather than in some other one.

Since demographic guidelines are the intermediate link between a person's behaviour and the concrete social environment, concrete analysis of various types of guidelines in different areas of a country and in different national, social, and geographical communities of people is possible.

By employing the concept of demographic guideline we can come close to understanding how the system of socio-economic factors influences demographic behaviour.

Chapter 5

SOCIAL HYGIENE

A. M. Merkov, D. Sc. (Med.)

Demography's study of population problems is organically supplemented by social hygiene, the social science of the health of a population in a system of social measures ensuring the prevention and treatment of illness, the prolongation of life, and improvement of the people's health.

The link between demography and social hygiene stems from the fact that the object of the research and active impact of both is the population.

Social hygiene may, to some extent, be provisionally divided into two parts, descriptive and normal. The first studies and describes the facts characterising the health of the population and brings out its development pattern and links with and dependence on various factors in the social environment. The second develops and implements measures affecting the factors of the social environment, with the aim of reinforcing their improving effect and eliminating or altering them when they have an unfavourable impact on the people's health.

A people's health is appraised on the basis of a complex study and estimate of three groups of indices characterising its reproduction: namely, morbidity and its various forms; the physical development of its main sex and age groups and ethnic and social groups. Only the last subdivision (physical development) does not in some degree or another need hygienic and demographic data. It is limited to the simplest grouping of the assembled facts

by elementary demographic criteria of those under examination (age, sex, ethnic and social group) with subsequent quite complex variational-statistical processing.

The main prerequisite of the assembled material studied for statistics of morbidity is demographic data, and the main methods of studying them are statistico-demographic research techniques.

Investigation of a population's morbidity only makes sense from the point of view of social hygiene when it is carried out not in relation to the population in general but as regards its uniform social groups, taking the features of their sex, age, occupational, cultural composition and so on into account, and allowing for the different degrees to which they are affected by separate factors of the social environment (housing, communal services and amenities, the composition and character of nutrition, hygienic and living habits, and so on). This kind of grouping of the data on morbidity calls for exact information on the composition and location of the population, which the social hygienist investigating it obtains as a rule from the relevant demographic data. When such data are not available he has to gather them himself independently, employing the methods of demographic statistics for the purpose.

A detailed grouping of the statistics on morbidity, however, leads to their marked fragmentation. If the total population whose morbidity is being studied is not sufficiently large, the partial indices obtained for it are not sufficiently reliable statistically. That is particularly so when the partial morbidity indices are taken in cross combination (e.g., the age and sex indices for different diseases for separate social or occupational groups). In that case increasing the studied aggregate to the size needed to ensure statistical reliability of all the indices obtained is often impossible, either because of the limited size of the population of the area being studied or because of the excessive expenditure of labour and money required for the study. The application of certain statistico-demographic techniques for processing the assembled data (e.g., the use of standardised indices that eliminate sex, age, or other such differences in the groups being studied) is then the sole possibility for a fundamental study of morbidity.

The value of demography for morbidity statistics, however, is not exhausted simply by taking demographic groupings as the basis for grouping data on morbidity, or by statistico-demographic research methods being used to study it. The use of the patterns of change in the composition of a population brought out by demography, especially in its age and sex composition, is of no little significance, as can be demonstrated from the changes in the age composition of the population of the USSR. Persons under 15 years of age inclusive constituted 37.7 per cent of the population in 1939, 30.4 per cent in 1959, and 30.9 per cent in 1970, while those of 15 to 49 years of age made up 55.5, 60.2 and 57.3 per cent respectively. The proportion of the elderly (above 60) rose from 6.8 to 11.8 per cent between 1939 and 1970.

A considerable increase in the proportion of elderly persons in a population leads to changes in the structure of morbidity and causes of death (an increase in the number of protracted illnesses, in particular of cardio-vascular diseases and malignant tumours) and calls for the institution of special measures to study the physiology and pathology of the elderly and aged organism, the organisation of medical and health services for the elderly, and the improvement of measures to prevent and treat cardiovascular diseases and malignant tumours.

Finally, the third section of the data characterising a population's health, i.e., information on its structure and reproduction, is directly demographic. The public health significance of data on reproduction is so great that they are often, with justification, called hygienic-demographic, thus signifying their community of interest for both social hygiene and demography, with their different approaches to analysis of the facts and interpretation of the results.

For social hygiene reproduction rates serve as a kind of "barometer" of population's sanitary conditions. A higher death rate, given a similar age composition of comparable groups, always means worse sanitary conditions, a rise in mortality while preserving the former age structure of the population, and a deterioration in its health. As for natality, changes in its general level and a difference in the fertility index for the different groups of a population, even with a similar age and sex structure, cannot

be evaluated so directly. The indices of natural population growth obtained as a result of high natality and high mortality may be equal to, or even lower than, the corresponding indices for a lower natality and lower mortality.

Given high mortality, especially infant mortality, high natality signifies, from the angle of social hygiene, an irrational expenditure of labour and money on maintaining and bringing up children who are being lost, and the conversion of women into "birth machines". It is not fortuitous that the combination of high natality and high mortality has always been inherent in economically weakly developed countries, whose populations have suffered brutal social exploitation, and too often colonial or semi-colonial oppression. In all these countries high natality has been accompanied with high mortality, and has by no means been a positive public health phenomenon.

From the aspect of social hygiene, however, one cannot consider the opposite event positive either, when low mortality is combined with extremely low natality. When the birth rate is lower than the death rate (a relatively rare event) there is a danger of depopulation; but even when depopulation does not occur as yet but mortality is not quite compensated by natality, the net reproduction rate though not yet below unity is already close to it, and extended reproduction is gradually changing to simple reproduction. Such a ratio of birth and death rates is also evidence that things are not right as regards a population's sanitary conditions.

The causes of such troubles may be various (directly economic factors, difficulty in providing housing, food, etc.). The joint task of demography and social hygiene in such cases is to study and clarify the reasons for the excessively low fertility rate, and to work out measures for demographic policy and of a health-improving order ensuring maintenance of a sufficiently favourable balance of births and deaths and an optimum net reproduction rate.

In the field of developing measures to promote natality the jobs of demography and social hygiene are more or less the same. But as regards a further lowering of mortality, and of ensuring a better balance of births and deaths, the decisive role belongs to social hygiene. Study of causes

of death and of their dependence on environmental factors, and the development and organisation of measures to ensure lower morbidity and other causes of death, preserve the lives of children already born, and prolong the life of the adult population are all the sphere of social hygiene, and of its most important subdivision, the organisation of health protection.

Demographic indices of the average life span of persons of different sex and age, and their alteration with time, are the most important complex indicators of shifts in the people's health employed in social hygiene.

Increasing the life span of the population is seen as one of the principal tasks in the health field in the Programme of the Communist Party of the Soviet Union. The final goal of all the measures of the Soviet health service to reduce morbidity and mortality is to realise these tasks, i.e., to prolong the life span of the people; it will be achieved not simply by medico-hygienic measures but also by general ones aimed at improving the well-being and everyday material and living conditions of Soviet citizens.

In the general complex of measures in the struggle to prolong life, however, no small role is played by the social hygiene work of the health authorities. It is quite proper, consequently, to consider changes in the average life span a basic complex index of the degree to which the health service is achieving its main aim. That is especially so when the appropriate age and sex indices are used and not just a single index of the average expectation of life of the newborn.

Public health-improving measures are not only implemented as general steps in relation to the population as a whole, but are also differentiated for various age and sex groups. That is why changes in the age and sex indices of average life expectancy are the best complex indicators of changes in the population's health, and of success in implementing public health measures.

Taking the USSR as an example, we can see how changes in the character of demographic processes govern the tasks of the health service as regards public health and social hygiene. The progress made in reducing mortality and increasing average life span in the USSR is great and unquestionable. In 1913, on the present-day territory of

the USSR, 29.1 persons per thousand died; in 1974 the figure was 8.7. That means that 20.4 fewer persons in every 1,000 of the population now die in a year than would have died if mortality had remained the same as in tsarist Russia in 1913. One can easily calculate that, with a population at the beginning of 1974 of 250,900,000, more than 5.1 million lives were saved in 1974 alone.

Progress in reducing infant mortality has been especially graphic: 269 children in every 1,000 born died before reaching one year in 1913; in 1974 infant mortality was only 28 per 1,000 births, i.e., about a tenth of the level in 1913. That means that out of every 1,000 babies born now the lives of 241 are saved, who would have died if their mortality had remained as it was in 1913. Again it can easily be calculated that, with a birth rate in 1974 of 18.2 per 1,000 population, the total number of babies born in 1974 was more than 4,500,000, of whom around 1,100,000 remained alive only thanks to advances in reducing infant mortality.

In tsarist Russia the average life span in 1896-97 was 32 years. In the USSR in 1971-72 it was 70. That means that the average Soviet citizen in 1971-72 could live 38 years longer than would have been the case in Russia in 1896-97.

The main advances in reducing mortality in the USSR, however, have already been made. The indices for 1974 varied around nine persons per 1,000 inhabitants.

This progress in reducing mortality was the result of many socio-economic achievements, in particular, it was the result of successful struggle against acute infectious diseases, acute gastro-intestinal ailments, and diseases of the respiratory organs and tuberculosis, which used to be the main causes of death. At present the main causes of death in the USSR are cardio-vascular diseases and malignant tumours. There is no doubt that medical science will find radical means of preventing and curing them in the relatively near future, but until these means are found the chances of a significant reduction of mortality from them are limited.

The main reserves for a further lengthening of average life span at present are a lowering of infant mortality and of mortality from infectious diseases, and reduction of the number of deaths from injuries and accidents; but

because the number of deaths from these causes (with the exception of accidents and injuries) is on the whole a relatively small fraction, further progress in this respect will have less effect than heretofore in lowering the general death rate.

The main source for a further increase of population in the USSR at present is through maintaining an adequate birth rate, while reducing mortality.

In 1913 in Russia 45.5 children were born for every 1,000 of the population; in 1940 in the USSR 31.2 children were born per 1,000 population, 25.3 in 1958, and 24.9 in 1960. Until 1958 the fall in natality was compensated by an even greater decline in mortality (which was 29.1 per 1,000 population in 1913, 18 in 1940, and 8.7 in 1974). As a result, natural increase per 1,000 population was 16.4 in 1913, 13.2 in 1940, and 18.1 in 1958. Subsequently, however, the death rate became relatively stabilised with a certain rise in 1972, while natality continued to decline, reaching 17.0 per 1,000 in 1969. Since then, it is true, it has risen slightly and reached 18.2 per 1,000 in 1974. Consequently, even if mortality had been reduced to zero in 1974 (which is practically impossible) the natural increase of the USSR's population would then have only been about the 1958 level. In fact it was only 9.5 per 1,000 or about half that of 1958. These figures make clear the socio-hygienic significance of the natality problem today.

In this connection an immediate and urgent task of Soviet social hygiene is to carry out fundamental research.

At the same time attention needs to be paid to developing means of lowering mortality further in all age groups and regions where it has not yet been brought down to the level for the USSR as a whole, or of the regions and republics that are most advanced in this respect.

The patterns revealed by demography are of great importance in organising the health service; therefore exceptional attention is being paid to these problems in the USSR.

The tasks of social hygiene, which are determined by the reproduction processes and by changes in the age structure of the population, have been set out above; but in order to define, develop, and implement the tasks of organising

health protection the information provided by demography on the population's numbers, sex and age structure and distribution is of special value, and that in addition to the data on reproduction. Without taking these facts into account it is impossible to plan measures to improve the people's health because the scale of the system of medico-hygienic institutions, the requisite numbers of medical personnel, and even to some extent the direction of their activity, are determined by the specific features of the structure and distribution of the population.

Within the general principles of a socialist health service, the forms of medical care differ, for example, for the urban and rural population of the USSR, and the dynamics of their numbers are not the same, which has a considerable effect on planning of the health service. It also, correspondingly, governs the development of sociohygienic measures to improve health.

Section Three

METHODOLOGICAL PRINCIPLES OF STUDYING DEMOGRAPHIC TRENDS

A scientifically validated analysis of demographic processes presupposes generalisation of a large volume of varied information adequately reflecting the picture of population development. Following the gathering of information comes the stage of generalising and analysing it by various techniques, primarily by various kinds of models enabling us to understand the driving forces and mechanism itself of demographic phenomena better. Very great importance attaches to the development of models showing the interconnection of economic and demographic processes, and to further improvement of the indices characterising a population's reproduction regime.

Chapter 1

STATISTICAL METHODS

A. G. Volkov, Cand. Sc. (Econ.)

Historically population was the first object of statistical accounting, and demographic phenomena, the field in which statistics was developed as the science of methods of quantitative study of mass phenomena. Although the establishment of systems of statistical observations and the accumulation of facts on population came about under the direct influence of social needs, an important stimulus to the development of statistical accounting and analysis as well was the search for general patterns in demographic processes undertaken by the first representatives of demographic science.

Theoretical views on the laws of population movement were developed up to the end of the nineteenth century within the framework both of political economy and of sociology. Investigation of the patterns of demographic processes, however, continued steadily in the bed of statistics, which gave grounds (and occasionally still does) for considering demographic science identical with population statistics and denying it the right to an independent existence.

The study of population, being the earliest and broadest field of application of statistics, was differentiated as an independent science later than other fields of social knowledge. "There remains to statistics, in its undivided sway, only a very narrow sphere, still not disputed by any other science: the statistics of population, and in part moral

statistics," A. A. Kaufman wrote at the beginning of this century. "And that is because a regularity prevails in these fields which we are not yet able to explain and to assign by our explanation to any other definite science whatsoever...." Such a state of affairs, however, he said, "undoubtedly has a temporary, transient character. In the course of time, one can confidently expect, this kind of phenomena will be explained and they too will be transferred to the competence of other sections."[1] That forecast can now be considered borne out.

The limiting of population statistics to a methodological role, we must emphasise, in no way lessens its significance in the study of demographic processes. Statistics, which Lenin called one of the most powerful tools of social knowledge,[2] also performs this function fully in the study of population. As a branch of practical activity it provides demography with a major part of the facts on which the latter bases its investigations.

The value of statistical methods in demography is not simply owing to social and economic statistics having developed for a long time precisely as population statistics, since (as M. V. Ptukha has justly remarked[3]) the number of inhabitants and the density of population in general gave a correct idea of the wealth and power of a country and of the level of development of its powers of production. No less significant is the fact that population and the processes of its movement have proved favourable soil for the application of statistical methods.

Demographic phenomena are mass phenomena. Population is an aggregate of people endowed with such and such attributes. Demographic processes are built up from a host of individual cases of birth, marriage, change of domicile, and finally of death; but their mass character in the statistical sense comes not from the plurality of the individual cases from which they are built up, but from the fact that there is a combination of the necessary and

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[1] A. A. Kaufman. *Vvedeniye v teoreticheskuyu statistiku* (Introduction to Theoretical Statistics), Petrograd, 1923, pp. 544-45.

[2] See V. I. Lenin. The Capitalist System of Modern Agriculture, *Collected Works*, Vol. 16, p. 437.

[3] M. V. Ptukha. *Ocherki po statistike naseleniya* (Essays on Population Statistics), Moscow, 1960, p. 95.

the random in them, a combination of causes making for variation of the index.

The partial, random causes do not allow us to clarify the general pattern of the process in each individual instance, or to grasp the necessity inherent in it, which only comes out in a mass of cases when the effects of the partial, random causes cancel each other out and the pattern proper to the given phenomenon can be discovered.

This pattern emerges quantitatively in the form of empirical statistical regularities, which are the manifestation of general laws revealing the essence of the phenomena. In disclosing the recurrence of phenomena and the regularity of their development, the statistical pattern indicates that certain causal relations underlie them. While these causal relations—the general laws of development of a population—are the business of theoretical demographic analysis, discovery and investigation of the empirical statistical patterns of mass demographic phenomena call for the application of statistical methods.

Although statistical methods of studying mass phenomena are applicable in general to any aggregate, it is impossible in fact to ignore the specific character of the object being studied; it determines what methods to use, the specific nature of their application, and their informative significance.

The specific features of a population as an object of statistical study are the following:

(1) its variety, i.e., the multiplicity of the characteristics of the people, who form a series of interconnected structures; insofar as people's attributes are interconnected, the structure of a population taken by any one of them reflects its structure according to the others; at the same time these attributes may have a host of values (e.g., employment, nationality), which makes population an extremely heterogeneous aggregate;

(2) its variability: population is an aggregate that is being constantly renewed through its own reproduction; in a closed population in which there is no migration, this is self-renewal; in an open population it is complicated by migration;

(3) the linkage of structure and reproduction: a population renews itself while preserving a certain structure due, to a considerable extent, to the character of its repro-

duction; changes in the demographic processes alter the structure of a population, while changes in its structure in turn are reflected in intensification of the demographic processes;

(4) the fact that demography is concerned with such specific aggregates as generations (demographic events of one kind or another being considered in reference to their life) as well as with the characteristics of aggregates of people and aggregates of demographic events (analogous as regards the application of statistical methods to other social aggregates);

(5) finally, the fact that population is mainly characterised by qualitative categories, definite values of which people may or may not possess. Quantitative indices are employed comparatively less widely, being mainly discrete categories.

The aggregate of statistical methods with which we are concerned embraces scientific methods of gathering, processing, generalising, and analysing data on population applicable for disclosing the patterns of its movement and reproduction in the mass demographic data.

Even theoretical analysis of reproduction patterns is based in the final count on past experience. Facts have the greatest significance for disclosing and studying the concrete patterns of demographic processes which, as social phenomena, are distinguished by complexity and variety. The methods of gathering the facts about a population are therefore of the utmost importance in the complex of statistical methods. Lenin required that any study of socio-economic phenomena should be based on a firm foundation of exact and indisputable facts.

In view of the fact that population has long been and will continue to be an important object of statistical study, the methods of demographic observation are to a considerable extent identical with those of statistical observation of social aggregates in general; at the same time the latter have their own specific features in demographic research.

An important feature of the observation of demographic phenomena is associated with the fact that demographic events (marriage, the birth of a child, change of domicile) must happen at a certain time when certain external circumstances of one kind or another are operating, the

effect of which it is necessary to study, and in addition (since these events occur with different intensities at different stages in people's lives) at a definite period in their life or the life of a generation.

In observing real demographic facts these requirements may be met in one of two ways: either by observing a cross-section, i.e., a cross-section of the events taking place at one and the same time but among the persons composing the population at the given moment and consequently belonging to different generations; or by longitudinal observation, i.e., the registration of events taking place at different periods in the life of one and the same generation, and consequently at different periods of calendar time. Longitudinal observation may be current, when one and the same generation is observed as it is passing through some stage of its life, or retrospective, when events are recorded that took place in its past. Correspondingly the technique of observation and rules for processing the data are differentiated.

Any event in the life of people depends on their age not only by virtue of the biological peculiarities of the human organism's maturation and ageing, but also because people's social functions and their place in the system of social production, and social relations in general, are closely linked with their age. Hence the obligation to record age in one form or another in demographic observations and to take measures to make it precise, which presupposes that the aggregate of the people among whom the given demographic events are being observed must also be defined in observations.

The intensity of demographic processes (other conditions being equal) varies in different demographic situations. The probability of divorce, for instance, is different for marriages of different length; the probability of the birth of a child depends on the interval that has passed since the birth of the previous child, and so on.

Consequently it is necessary during observations to record not only the fact itself of a person's being in a certain situation but also how long he or she has been in it. Retrospective observation makes it possible to record all cases of change of state or situation (birth of children, migration) and their dates, which helps to fix their time definitely and (since date of birth is taken into account)

to assign them to a definite period in people's lives. With one-time observation, of course, this is only possible in relation to what is happening at the moment of observation.

Yet another feature of demographic observations is linked with choice of the object and units of observation.

Population is usually observed as an aggregate not only of persons but also of families. Distinguishing the family as the object of observation calls for clear-cut definition of a family which is not so simple. With the growing mobility of population the traditional criteria of a family (common dwelling, kinship, and a common household budget) are insufficient. Relatives, though living apart, often preserve close economic links. There is a certain category of family, territorially separated, in which the husband occasionally lives for a long time apart from his wife and children (in any case for most of the week); and people live together who are not related to one another. Finally, some of the criteria defining a family should, it would seem, be established on the basis of the purposes of the research. An important line of research is study of the processes by which families themselves are formed and break up; the processes are quite complicated to observe in view of their being protracted in time. A special problem is delimitation of the concepts of family and household, which have not yet been clearly defined, and apparently cannot be, out of context of the social organisation of society, cultural traditions and way of life, and so on, all of which preserve their significance when the family is taken as the unit of observation.

Since demographic observation pursues the aim of obtaining information on the distribution of population by such and such a criterion, the criterion must be ascertained for each person by one and the same rules. Information is often obtained by means of questionnaires of one kind or another (oral questioning, self-recording, or in recent years through the distribution of written questionnaires). Back in the middle of the nineteenth century Adolf Quételet had established rules for the statistical observation of a population: to gather the information that was required and that could be obtained by questioning and would not arouse misgivings among the public. These rules retain their value to this day. It is worth

recalling in this connection the apprehensions of the organisers of the US 1970 census that the census questions might arouse hostility among the public. The experiences of censuses and observations in the USSR is that cases of refusal to answer, or of deliberately false answers, are seldom encountered; nevertheless the psychological aspect of the questioning does not lose its significance.

Two people are involved in questioning, the person questioned and the questioner or recorder. When qualified personnel are selected as recorders, when the questions are posed in a clear-cut way and in convenient form, and when a strict sequence of questioning is observed and its observance controlled and checked, one can be confident that the questioning will be done successfully. As to the other party, the person questioned, matters are more complicated. One must allow for his or her attitude to the object of the investigation and the acuteness of the problems involved. Thus, for example, experience of taking part in the Soviet 1970 census showed us that many widowed women were disinclined to call themselves widows and considered themselves married, which apparently reflects a common conception of marriage as a formal union (that is not dissolved even though the husband is dead). That is why, possibly, the number of married women considerably exceeded the number of married men in that census. It only remains to add that social-psychological factors are particularly important when studying opinion, especially when investigating the motives for demographic behaviour, which is now a legitimate form of demographic research.

Selective investigations and selective recording (sampling) have great value as sources of information on population and demographic processes. In addition, the sampling method of research is being widely employed in demography in general as a system of procedures for gathering, processing, and analysing demographic data.

A specific feature of the sampling method is that the results of a sample should only serve as the basis for obtaining certain characteristics of the whole aggregate being studied, and that the system of procedures and principles for sampling this part should ensure that results of adequate accuracy are obtained. (That does not mean, of course, that we cannot, for practical purposes,

employ, say, a sample distribution of families according to number of members or some other criterion. The point is that a certain degree of correspondence between the sampled distribution and the general is always implied.)

Thus not only is observance of certain scientifically substantiated rules of selection characteristic of sampling technique but also evaluation of the parameters of the total aggregate according to the sample data, evaluation of which is the end result of the sampling. The appraisal (or extension of the sample data to the total aggregate) involves calculation of the estimates following certain rules, and discovery of their errors, i.e., calculation of the margin of error within which the evaluated characteristic will lie with a given number of observations and a given order of selection.

Wide use of sampling in socio-economic research, and in particular in demographic studies, began only at the end of the nineteenth century. The initial material for developing the theory of sampling as a theory of random selection was first the errors in repeated measurements of one and the same value in astronomy, geodesy, and the natural sciences. Application of the principles of random selection to socio-economic aggregates was held up because of their qualitative heterogeneity and the interconnected nature of socio-economic phenomena, which did not admit of chance variation.

Evidence of the correctness of the law of big numbers for cases of dependent tests, and the extension of the principles of random selection to finite aggregates, opened the way to sampling methods in demographic research. The development of the methods of so-called finite random sampling, furthermore, was in fact linked with demographic research, i.e., methods like sampling with probabilities proportional to the magnitudes of the selected units; typical or zoned selection; certain techniques of systematic (or mechanical) selection from ranked series, and so on. All these modern techniques were tested and developed in the field of socio-economic research, and especially in demography. The method and practice of multistep selection now common were developed directly in this field; so too were certain specific techniques of serial or cluster sampling.

Application of the techniques of finite random sampling, it must be stressed, in no way lessens the value of the sampling method of research. In the cases mentioned above the selection remains in the final analysis unpremeditated, and the methods of evaluating and calculating errors enable one to obtain reliable results with the given sample itself and to guarantee the margin of error with a certain probability.

The specific feature of employing sampling in demographic research is determined by the specific features of the settlement of people, which has a clearly expressed cluster character. This governs the multistep of use sampling with selection in the last stage of the series or cluster of units (families, flats, apartment houses). In view of the fact that the separate elements in the cluster are similar to one another in respect of certain criteria it is necessary (when calculating the error of a sample or evaluating the parameters of the total aggregate) to take what is called the intra-class (or intra-cluster) correlation into consideration.

The heterogeneity of population suggests broad application of typical or zoned selection, i.e., preliminary sorting out of the population to be studied into more or less uniform groups. Since population is always settled by area, areal or regional methods of selection are of great value.

The sampled data are used to characterise the structure of the population. Calculation of errors and the evaluation of criteria by proportion and not by average are therefore of great significance. An important task is to develop techniques of evaluating a system of indices rather than isolated ones.[1]

Other applications of sampling in demographic research are less often met. In particular, as follows from the foregoing, there is limited application of small samples. In local research an evaluation of the significance of the difference between two sample averages is quite often employed.

The next stage in applying statistical methods is systematisation and generalisation of the data gathered during observations.

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[1] The problem of the organisation of sampling observations does not concern us here.

The first step here is to group the information obtained and to form distribution series. The special importance of correct grouping of demographic data follows from the fact that a population is a social aggregate as well as a biological one. The distinguishing of socio-demographic types, the differentiation of the studied population first of all into socially uniform groups, and the distribution of demographic events according to these groups are consequently a *sine qua non* and prerequisite of profound, all-round analysis of demographic processes. Marxist demography is guided in this by the scientific principles of socio-economic grouping developed by Lenin.

Demographic research is not, of course, limited to the social differentiation of demographic phenomena. Fundamental study of socially uniform groups presupposes their further differentiation by several criteria important for the research. The mutual link between a population's structures noted earlier makes it especially important to distribute demographic phenomena by groups that are also uniform in a demographic sense, with the aim of ensuring comparison in respect of the population's composition. Thus, for example, when we are grouping families by size we must take their composition relative-wise into account, and also the age of the members of the family. The distribution of population by family status is not very informative if it is not accompanied with a grouping of the data by sex, age, etc.

Two kinds of distribution series are distinguished: (1) by some one attribute of the population itself (its sex, age, occupational, or educational composition) or by its groups (families by size, towns by population); and (2) by some attribute or other of the demographic events (births, deaths, marriages, cases of migration, etc.). In either case it is particularly important to have a distribution by age and by the length of time spent in a certain demographic state. The graphic representation of demographic events presented as a function of age or time should resemble a smooth curve. The techniques of obtaining such smooth curves from direct data, known as smoothing, occupy an important place in the arsenal of the statistical methods employed in demography.

A population's composition, looked at statistically,

is mostly a distribution by qualitative criteria (employment, education) or by quantitative ones of a discrete character (number of persons in the family, number of children in a family). This circumstance also lays its stamp on the generalised characteristics employed to analyse the relevant series: characteristics of structure acquire relatively great significance, and summary (composite) and average values relatively less. The heterogeneity of a population's composition often makes it illegitimate to calculate averages, which in this case characterise a qualitatively heterogeneous aggregate.

The form of average or mean generally used, the arithmetic mean, is not of much use for characterising the most important age distributions. (1) The researcher's job in most cases is to characterise the whole distribution as concerns one generation or another, the shape of the curve, the ratio of its parts and the steepness of its slope. (2) This distribution occasionally has two peaks, as for example the distribution of the number of deaths in age-specific mortality tables. Here the arithmetic mean (in this case average life expectancy) will, as Korchak-Chepurkovsky remarks, be "an atypical magnitude lying between the two characteristic maxima of the tabulated frequency of deaths".[1] (3) The arithmetic mean, since it depends on all values of the criterion in the series, is of little use in cases when the distribution is variable and is determined by the effect of several causes, including the earlier intensity of the reproduction process. Thus, for example, the average age of divorced persons is not very indicative as a characteristic of the age distribution of divorces since (if the divorce rate does not alter with time) this distribution depends much more on the preceding age-specific nuptiality.

For that reason, too, indices of variation have comparatively little value as they characterise deviation from the same mean and do not help when one has to investigate the patterns of the shaping of such and such a distribution. In some cases calculation of the arithmetic mean lacks point in general. When the averaged cri-

[1] Y. A. Korchak-Chepurkovsky. The Effect of Mortality at Various Ages on Increasing Average Life Span. In: *Izucheniye vosproizvodstva naseleniya* (Studies in the Reproduction of Population), Moscow, 1968, p. 135.

terion from which the mean is derived is discrete (e.g., the sequence of births), the mean is meaningless, and it is better to employ what is in fashion.

Thus the arithmetic mean does not play any great role in demographic research. It is often preferable to use place or structural means, in particular the median. When the arithmetic mean is, nevertheless, calculated one must bear in mind the possible non-uniformity of the distribution. Thus the average age of mothers at the birth of a child very much depends on the distribution of women by length of marriage, which in turn is governed by the marriage rate of the generation under consideration.

Thus we reach two important conclusions: (1) it is necessary to characterise the spread of demographic events by a complex, by a series of characteristics rather than by any one value or another; (2) the distribution of demographic events taken by itself out of context of the environment in which they have occurred yields little for analysis, and can lead to incorrect conclusions.

Thus, in order to characterise demographic processes, we must resort to measures of their intensity or "the frequency of the phenomena in a known environment", i.e., to compare events of a certain type with the numbers of the set by which they are generated.

Four forms of measure of the frequency of demographic events are distinguished:

(1) probability (marriage, the birth of a child, death, etc.), i.e., the relationship between the number of such and such events occurring in the initial set of persons over a certain time and the numbers (size) of this initial set;

(2) independent probability, i.e., the probability of a demographic event, on condition that the studied set of persons is altered only by the effect of that given event;

(3) the measure of the intensity of such and such a demographic event, or of the intensity of a change in the situation in an infinitely short period of time;

(4) the coefficient or average rate of demographic events for any one period, i.e., the relation of the number of events taking place during this period to the mean population or to the time survived by this population over this period.

In practice demographic coefficients are used most. The measure of the intensity of events is used in analytical constructions; independent probabilities are used in studying the isolated effect of some one event, while dependent probability is the usual measure of demographic tables.

Demographic rates or coefficients should be calculated in relation to the set in which the given events have occurred or could have occurred. From that angle general rates, i.e., the number of events correlated with the total population as the generally used measure, have been least methodically validated. Formally, only computation of the general death rate is methodically valid, since everybody dies. But it, too, is a sweeping or indiscriminate mean, calculated for a set that is very heterogeneous from the standpoint of man's liability to the action of causes leading to death.

The birth rate is subject to the effect of the proportion of women of fertile age in the population, and the proportion of them who are married. Even less valid is the general marriage rate or divorce rate calculated in relation to the whole population (usually per 1,000 population), since only those who are not married can contract marriages, and only those who are married can divorce. General coefficients or rates are not reliable measures. Furthermore, by virtue of their liability to be affected by attendant circumstances, their dynamics cannot be used to forecast the outlook for a change in the rate of demographic processes. Their wide use, unfortunately not simply in the special literature, must therefore be attributed rather to the tradition of so doing, or perhaps to the extreme simplicity of their calculation.

General rates can be regarded as averages of partial ones (characterising the rate of events in separate groups of the population), weighted by the numbers or the proportions of these groups. Their magnitudes therefore greatly depend on the ratio of their numbers or the structure of the population. They are also influenced, of course, by the difference in the indices for the separate groups themselves. Study of general indices of the rate of demographic processes should therefore be supplemented by analysis of the population's structure and differentiation of the indices by its different groups. Here we must dis-

tinguish between differentiation by differences in the character of the reproduction of the various groups and differentiation associated with changes in the rate of a process over the whole life of a generation. The latter is normally expressed by a system of coefficients for various ages representing the rate of the process as a function of age. In demographic tables the probability (demographic) of one event or another is usually considered a function of age.

The interpretation of demographic coefficients, including demographic indices in general, as averages of different groups weighted by the numbers of the group, brings out the role of a population's structure when these indices for its various groups, and for different areas and periods of time, are compared. In view of the differences in structure of comparable populations general rates are not directly comparable. Special methods have been developed to make them so, eliminating the structural differences in the populations being compared. These methods, which were developed in the second half of the nineteenth century, are known as standardisation.

In its simplest form standardisation consists in calculating average rates weighted by the structure of some standard population (hence the name of the method), rather than of the population for which they are being computed. The structure of the whole population is taken as this standard (when we are comparing the indices of its groups) or any common structure (for comparing the rates of different countries), or one structure and then another, in turns. Often it is not the indices of a real population that are taken as the standard but the indices and structure of some model of it. Standardisation is generally employed to eliminate differences in a population's age structure; the method is also used in principle to eliminate the effect of any structural differences.

Standardisation is a generally accepted method for the reason that we seldom have to do with uniform groups of population in demographic comparisons. It is obligatory in comparative analysis; but we must not overlook its drawbacks. The magnitude of standardised rates depends on the character of the standard itself. No model whatsoever of population is free of this defect when used as a standard. Standardised rates therefore have no indepen-

dent value in fact, and are only useful for comparison.

Since differences in the rate of one process or another may be linked with the population's structure by more than one criterion, single standardisation does not give the required effect; double and triple standardisation are therefore employed, in which the specific character of the population being studied is eliminated to an even greater degree. Finally, a population's structure is not something external as regards its reproduction but represents the result of that process in the past and its basis for the future. By getting rid of the effect of differences in structure we gain the possibility of comparing them, but we also lose the specific character of the phenomenon.

Standardisation has also begun to be used in recent years to study the effect of such and such structural changes in their dynamics, and to study components of the change in general demographic rates. In these cases the population's structure in the initial period according to one or more criteria is taken as the standard. But it must be remembered that such consecutive standardisation does not yield additive rates and that it only brings out the degree of the effect of separate factors and not their comparative strength.

By basing ourselves on the age dependence of demographic events we can calculate the significance of the function of the rate of demographic events mentioned above within definite age limits (from zero to 100 when studying mortality; from 15 to 50 when studying fertility, and so on), and represent the order of successive changes of this rate with age in the life of a generation, and in its various stages. But this method is complicated in practice and inexpedient for tracing the changes taking place in the life of a concrete generation, since by the time the observations have been completed the facts will have only had historical interest. Meanwhile the population is changing continuously and at any given moment or period of observation it has a definite age structure and consists of people who are at earlier rungs of the age ladder. Rates calculated for this period for each age group thus yield a full set of age-specific rates, which form a series as it were of the change of the relevant rates with age for a certain imaginary (hypothetical or arbitrary) generation. This series is built up through the effect of causes operat-

ing on the demographic processes at the present time.

The system of rates for a hypothetical population reflects the patterns characteristic of a given time, and at the same time represents a system of rates for a whole generation. The most common generalising characteristic of the mortality of this generation is the widely known index of average life expectancy for a given period. This index does not reflect the span of life of people living now or, furthermore, the average life span of any concrete generation (since it is based on indices for various generations), but reflects the average number of years that a person born (or reaching a certain age) at a given time would live to if, during his or her life, the death rate at each age were the same as now. There is a similar measure for the fertility of a hypothetical population, the index of total fertility, or the number of children that would be born to women reaching child-bearing age at a certain date, if fertility remained unaltered at each age during the whole time they were of that age.

The method of devising such systems and of analysing their characteristics is called the method of cross-section analysis or method of a hypothetical generation. It finds wide application in demographic calculations and analysis.

The characterisation of this hypothetical generation is often transferred to real generations as its components, i.e., it is taken that they will develop as indicated by the model. The method of forward calculation of population used in fact to be based on this transfer, but a weakness of the method has been discovered in it. In fact the conditions of a given period do not remain unaltered, and the rate of demographic events at different ages varies in accordance with them. The indices of a hypothetical generation are affected by various concrete conditions and do not provide a proper representation of the dynamics of one demographic phenomenon or another.

In war time, for example, family connections are broken, births are deferred, and fertility falls; but with its ending, there is a so-called compensatory rise in the birth rate, which is strongly reflected in the fertility rates of the hypothetical generation. Even if the total number of births per woman does not alter, the indices for the hypothetical generation will vary through the impact of

these temporary, transient circumstances. Given constant spread of conscious planning by parents of the number of children in the family, and the fact that an ever larger number of women are ultimately limiting themselves each year to a small number of children, the births may be deferred and occur at various periods in women's lives. The indices of the hypothetical generation, which are subject to variation in the situation, do not allow us to express this tendency with sufficient clarity.

In that connection the method of longitudinal analysis, or method of a real generation, has come to be used more and more widely in recent years; it consists in calculating and analysing the demographic characteristics of real generations of people. It is often also called the cohort method, understanding by "cohort" a group of persons simultaneously experiencing one and the same demographic situation, i.e., simultaneously born, simultaneously marrying, and so on. So far it has been mainly applied to study of fertility, since the child-bearing period in women is short enough to obtain indices without loss of their scientific and practical value. In contrast to the cross-section method of analysis, it is not age rates that are significant here but cumulative rates for different age groups (e.g., the number of children born at a certain age or after a certain period of marriage).

The longitudinal method of analysis makes it possible to study the general trends in the movement of demographic indices better, and from that angle provides greater possibilities for forecasting, in particular for predicting fertility. One must, it is true, assume with it that the next cohort will follow the same standards of demographic behaviour as the preceding one, i.e., we must interpolate the indices for cohorts that have not yet completed their cycle of child-bearing, on the basis of the rates for their predecessors. But as the trend of change shows up more clearly such extrapolation (with certain corrections) is more valid. Reliable forecasts of future trends in the principal demographic processes in any case presupposes an all-round taking into account of possible changes in the socio-economic factors affecting them. The methods aspect of this kind of forecast has not yet been adequately developed. The method of longitudinal analysis is being

widely used to analyse nuptiality and fertility, and is beginning to be used to analyse the dynamics of mortality.

A basic task of demographic research is to study the links between various demographic processes and their interconnections with social and economic phenomena. Like the other mass phenomena of social life these interconnections are due to a host of causes bringing with them a multitude of consequences, some of a fortuitous character. In order to discern the pattern in the relationships between criteria, it is necessary to eliminate the effect of these random variables, clarifying how a change in one of them is linked with changes in the others. In mass phenomena we are dealing with correlation linkages that develop only in changes of mean values.

The simplest picture of a correlation linkage is given by a combination table representing a grouping by two criteria; but though indicating the essence of the linkage it does not always enable its form to be established and does not permit its closeness to be measured. Only calculation of indices of the closeness of the correlation linkage, and writing of regression equations, give such possibilities.

Despite its comparatively long history, the formalism of correlation analysis has not yet been applied widely enough in demography, primarily owing to the technique of measuring the closeness of the linkage having only been adequately developed for quantitative criteria. There are as yet no adequate methods for measuring the connection of qualitative criteria. Meanwhile it is these criteria that are characteristic of demographic research where of great importance is the study of the composition of a population and the interconnection of its structures on the basis of its qualitative criteria. That applies in general, too, to study of the connection between demographic and socio-economic phenomena.

It is necessary, in addition, to study the correlation linkage of several criteria simultaneously. Even such tried and tested measures of the closeness of the linkage between qualitative criteria as Chuprov's and Pearson's correlation coefficients provide for the characteristic of the connection of two criteria only. When there is a large number of gradations in each of them, or in the case of mass data (the one

and the other are characteristic of demographic research) their application is complicated by the volume of the computations. The complexity of the calculation of the commonly used measures of multiple correlation before computers came into use for demographic computations practically excluded their application in this field.

For the reasons indicated above methods of so-called areal correlation are comparatively common in demographic work, i.e., techniques of establishing and measuring the links between some variates or others on the basis of their values for territorial units (towns, regions, districts) rather than for individual people (or families). One of the first experiments in such computations in the Soviet literature was Novoselsky's, who investigated the links between natality and infant mortality on the data of 50 provinces of European Russia.[1] At present this technique is quite widely used in demographic analysis, as it makes it possible to carry out a kind of substitution of quantitative indices for qualitative ones, and to represent them either as the number or the proportion of people possessing a certain attribute in the population of one territorial unit or another. The equations of multiple regression obtained enable the studied relations to be modelled and, if they are computed on a standardised scale, to evaluate the comparative value of the separate factors in the variation of the studied resultant variate. Since demographic data are prepared as a rule in territorial aspect, no special research is called for and the necessary calculations can be made from the data of the state statistics; the number of variates for which data are available is usually quite large, so that all the connections in any way essential can be encompassed.

Strictly speaking, however, the linkage measured here is not between variates in the aggregate of people (i.e., not in the population) but between variates of the territorial units (i.e., groups of people) that are sufficiently significant. Thus factors operating within each group and not accounted for can affect the results. A preliminary qualitative analysis of the system of possible linkages being studied is therefore especially important. The results obtained will be

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[1] See S. A. Novoselsky. On the Closeness of the Link between Natality and Infant Mortality, *Vestnik statistiki*, 1925, 4-6.

averages in relation to specific conditions for separate territorial units differing extensively among themselves. Thus averaged indices of the linkage will prove invalid not just for individual people but also for separate areas. For that reason it is necessary to use the models of the relations so obtained with great circumspection for forecasting purposes.

In recent years demographic models have come into quite wide use, models built on the basis of the correlation linkages of age indices, in particular the indices of mortality tables for several areas or periods. As an example we may cite the standard models of the mortality tables compiled by UN experts. In establishing the correlation linkages between the values of the separate functions of demographic tables, these models give a quite reliable measure for reconstructing the whole system of a population's demographic indices, which is particularly important when some of the initial data are incomplete or unreliable.

In conclusion we must note that the formalism of correlation analysis only makes it possible to clarify the existence of a connection and to measure its closeness, but tells us nothing about the character of its cause-and-effect relation. Use of these formal methods must therefore be accompanied with far-reaching logical analysis, which would make it possible (relying on the indices obtained) to establish whether or not there is an inner connection between the phenomena studied, and to interpret its sense.

The latter requirement applies not only to the methods of correlation analysis but also to the use of statistical methods in general in demographic work. Recognition of these methods as one of the most powerful tools for analysing the reproduction of a population still does not mean that they can operate automatically. Their proper use is no less important.

One must develop a working hypothesis of the character of the process being studied, and of the causes and circumstances of the existence of one phenomenon or another, on the basis of thorough preliminary qualitative analysis of the phenomenon concerned. The hypothesis is tested during the research, when it may be either confirmed or refuted by the facts.

Statistical methods have to be considered not as a collection of isolated tools but as an aggregate or complex of techniques. In planning observations one has to envisage clearly how the data will be processed, which indices will ultimately be obtained, and in what direction the analysis will tend. One of the commonest mistakes is that often no attention is paid in planning observations to the further course of the research, to having a scheme of analysis (if only a tentative one), and to picturing what hypothesis will be tested in the investigation. The absence of one variate or another in the programme of investigation can complicate use of the methods of analysis and occasionally depreciate the data obtained. Preliminary planning of the whole course of the research from beginning to end prevents the programme being overloaded with variates that it is not necessary to process, and at the same time avoids anything important being omitted. All these "general statistical" requirements are especially important in demographic work, which is usually of a mass character and conjugated with the processing of a great quantity of data.

Finally, it is important simply to use the known methods properly, for which it is necessary to have a clear idea of their indicative value, real sense, and conditions of use. The danger of improper use of statistical analysis is especially great when one of the tools of analysis is converted into a means of illustration and used to back up ready-made conclusions or preconceived ideas with statistical data.

In demographic work statistical methods are closely bound up with other techniques and methods. The specific character of the object of study leads to demographers' developing their own, so-called demographic methods of investigation (the methods of potential demography, the special methods of studying the reproduction of aggregates and the methods of longitudinal and cross-section analysis considered above), which are now becoming the property of other fields of knowledge as well.

Chapter 2

TABLES OF FERTILITY

Doctor E. Szabadi (Hungary)

In all industrial and developing countries today fertility has become the decisive component in population growth. Like other phenomena of demographic development it depends on a wide range of socio-economic factors. The population growth of individual countries and of whole regions depends much more on the future dynamics of fertility than on other processes.

Comparative investigation of the demographic processes of the socialist countries in Europe is one of the special fields of the Demographic Research Institute of the Hungarian Central Statistical Board, which it has been carrying on for some time now, and intends to pursue it in the future. Some of its results were published in a paper in the French journal *Population* (No. 5, 1966) that analysed general birth rates, and also regional birth rates in individual countries for the previous fiftyyears. The paper analysed general age-specific fertility rates and reproduction rates calculated for both sexes.[1]

In this chapter we would like, without pretending to treat the problem fully, to analyse the so-called basic tables of fertility, to present a scheme of possible lines of further research based on them, and to suggest problems that need to be tackled for our research to be complete (see the tables on the following pages).

[1] In the same issue of *Population* there was a paper by Chantal Blayo, a worker at the Institut national d'études démographiques, on other characteristics of population development in European socialist countries.

Tables of Fertiliy

A. USSR (1958-59)

Age groups (1)	Age interval (years) (2)	Order of survival (3)	Number of surviving in a stationary population (4)	Age-specific female fertility rates: For one year (5)	Age-specific female fertility rates: For a period equal to the age interval (6) = (5) × (2)	Cumulative fertility rate (7) = $=\sum_{0}^{\omega}(6)$	Number of births per given age group in a stationary population (8) = (5) × (4)	Cumulative fertility rate of a stationary population (9)= $\sum_{0}^{\omega}(8)$
0-4	5.0	1.00000	4.78524	0.00000	0.00000	0.00000	0.00000	0.00000
5-9	5.0	0.94823	4.72874	0.00000	0.00000	0.00000	0.00000	0.00000
10-14	5.0	0.94370	4.71045	0.00000	0.00000	0.00000	0.00000	0.00000
15-19	5.0	0.94044	4.69203	0.02920	0.14600	0.14600	0.13701	0.13701
20-24	5.0	0.93601	4.66567	0.16220	0.81100	0.95700	0.75677	0.80378
25-29	5.0	0.93013	4.56263	0.16480	0.82400	1.78100	0.75192	1.64570
30-34	5.0	0.92340	4.59782	0.11010	0.55050	2.38150	0.50622	2.15192
35-39	5.0	0.91550	4.55374	0.06660	0.33300	2.66450	0.30328	1.45520
40-44	5.0	0.90554	4.49654	0.02410	0.12050	2.78500	0.10837	2.56357
45-49	5.0	0.89256	4.42351	0.00500	0.02500	2.81000[1]	0.02212	2.58569[2]

Fall in the number of births in each age group, allowing for the effect of mortality (10) = (6) − (8)	Cumulative fall in the number of births in each age group, allowing for the effect of mortality (11) = $=(7)-(9)=\sum_{0}^{\omega}(10)$	Expected number of births after a given age, without allowing for the effect of mortality (per 100,000 women) (12) = $100{,}000\sum_{\omega}^{0}(6)$	Expected number of births after a given age, allowing for the effect of mortality (per 100,000 women) (13)= $100{,}000\sum_{\omega}^{0}(8)$	Mean expected number of births after a given age per woman, without allowing for mortality (14)= = (12) : 100,000	Mean expected number of births per woman after a given age, allowing for mortality (15) = (13) : (3)	Fall in the mean expected number of births due to mortality (16) = = (14) − (15)
0.00000	0.00000	281,000	258,569	2.81000[1]	2.58569	0.22431
0.00000	0.00000	281,000	258,569	2.81000	2.72686	0.08314
0.00000	0.00000	281,000	258,569	2.81000	2.7399	0.07005
0.00899	0.00899	281,000	258,569	2.81000	2.7494	0.06055
0.05423	0.06322	266,400	244,868	2.66400	2.61608	0.04792
0.07208	0.13530	185,300	169,191	1.85300	1.81900	0.03400
0.04428	0.17958	102,900	93,999	1.02900	1.01797	0.01103
0.02972	0.20930	47,850	43,377	0.47850	0.47381	0.00469
0.01213	0.22143	14,550	13,049	0.14550	0.14550	0.00140
0.00288	0.22431	2,500	2,212	0.02500	0.02478	0.00022

[1] Crude reproduction rate (R_b) (=1.37128), obtained by multiplying the given number of girls by their percentage in births in 1958/59 (i. e., by 0.488).

[2] Net reproduction rate (R_n) (=1.26182), obtained by multiplying by the same percentage. The calculations in Tables B-E were made in the same way.

B. ALBANIA (1960-61)

Age groups (1)	Age interval (years) (2)	Order of survival (3)	Number of surviving in a stationary population (4)	Age-specific female fertility rates: For one year (5)	Age-specific female fertility rates: For a period equal to the age interval (6) = (5) × (2)	Cumulative fertility rate (7) = $=\sum_{0}^{\omega}(6)$	Number of births per given age group in a stationary population (8) = (5) × (4)	Cumulative fertility rate of a stationary population (9)= $\sum_{0}^{\omega}(8)$
0-4	5.0	1.00000	4.47583	0.00000	0.00000	0.00000	0.00000	0.00000
5-9	5.0	0.87208	4.33680	0.00000	0.00000	0.00000	0.00000	0.00000
10-14	5.0	0.86397	4.31046	0.00000	0.00000	0.00000	0.00000	0.00000
15-19	5.0	0.86071	4.29581	0.06680	0.33400	0.33400	0.28696	0.28696
20-24	5.0	0.85734	4.27414	0.28108	1.40540	1.73940	1.20138	1.48834
25-29	5.0	0.85208	4.24347	0.31584	1.57920	3.31860	1.34026	2.82860
30-34	5.0	0.84513	4.20619	0.26790	1.33950	4.65810	1.12684	3.95544
35-39	5.0	0.83717	4.16402	0.20601	1.03005	5.68815	0.85783	4.81327
40-44	5.0	0.82822	4.11557	0.13361	0.66805	6.35620	0.54988	5.36315
45-49	5.0	0.81757	4.05736	0.05923	0.29615	6.65235	8.24032	5.60347

Fall in the number of births in each age group, allowing for the effect of mortality (10) = (6) − (8)	Cumulative fall in the number of births in each age group, allowing for the effect of mortality (11) = $=(7)-(9)=\sum_{0}^{\omega}(10)$	Expected number of births after a given age, without allowing for the effect of mortality (per 100,000 women) (12) = $100{,}000\sum_{\omega}^{0}(6)$	Expected number of births after a given age, allowing for the effect of mortality (per 100,000 women) (13) = $100{,}000\sum_{\omega}^{0}(8)$	Mean expected number of births after a given age per woman, without allowing for mortality (14) = = (12) : 100,000	Mean expected number of births per woman after a given age, allowing for mortality (15) = (13) : (3)	Fall in the mean expected number of births due to mortality (16) = = (14) − (15)
0.00000	0.00000	665,235	560,347	6.65235	5.60347	1.04888
0.00000	0.00000	665,235	560,347	6.65235	6.42541	0.22694
0.00000	0.00000	665,235	560,347	6.65235	6.48572	0.16663
0.04704	0.04704	665,235	560,347	6.65235	6.51029	0.14206
0.20402	0.25106	631,835	531,651	6.31835	6.20117	0.11718
0.23894	0.49000	491,295	411,513	4.91295	4.82951	0.08344
0.21266	0.70266	333,375	277,487	3.33375	3.28336	0.05039
0.17222	0.87488	199,425	164,803	1.99425	1.96857	0.02568
0.11817	0.99305	96,420	79,020	0.96420	0.95409	0.01011
0.05583	1.04888	29,615	24,032	0.29615	0.29394	0.00221

C. HUNGARY (1959-60)

Age groups (1)	Age interval (years) (2)	Order of survival (3)	Number of surviving in a stationary population (4)	Age-specific female fertility rates: For one year (5)	Age-specific female fertility rates: For a period equal to the age interval (6) = (5) × (2)	Cumulative fertility rate (7) = $\sum_{0}^{\omega}(6)$	Number of births per given age group in a stationary population (8) = (5) × (4)	Cumulative fertility rate of a stationary population (9) = $\sum_{0}^{\omega}(8)$
0-4	5.0	1.00000	4.76370	0.00000	0.00000	0.00000	0.00000	0.00000
5-9	5.0	0.94753	4.73197	0.00000	0.00000	0.00000	0.00000	0.00000
10-14	5.0	0.94548	4.72379	0.00000	0.00000	0.00000	0.00000	0.00000
15-19	5.0	0.94386	4.71302	0.05265	0.26325	0.26325	0.24814	0.24814
20-24	5.0	0.94114	4.69659	0.16105	0.80525	1.06850	0.75639	1.00453
25-29	5.0	0.93738	4.67603	0.10675	0.53380	1.60230	0.49921	1.50374
30-34	5.0	0.93288	4.65084	0.05460	0.27300	1.87530	0.25394	1.75768
35-39	5.0	0.92723	4.61725	0.02625	0.13125	2.00655	0.12120	0.87888
40-44	5.0	0.91903	4.56585	0.00766	0.03830	2.04485	0.03497	1.91385
45-49	5.0	0.90661	4.49116	0.00055	0.00275	2.04760	0.00247	1.91632

Age groups (1)	Fall in the number of births in each age group, allowing for the effect of mortality (10) = (6) − (8)	Cumulative fall in the number of births in each age group, allowing for the effect of mortality (11) = = (7) − (9) = $\sum_{0}^{\omega}(10)$	Expected number of births after a given age, without allowing for the effect of mortality (per 100,000 women) (12) = 100,000 $\sum_{\omega}^{0}(6)$	Expected number of births after a given age, allowing for the effect of mortality (per 100,000 women) (13) = 100,000 $\sum_{\omega}^{0}(8)$	Mean expected number of births after a given age per woman, without allowing for mortality (14) = = (12) : 100,000	Mean expected number of births per woman after a given age, allowing for mortality (15) = = (13) : (3)	Fall in the mean expected number of births due to mortality (16) = = (14) − (15)
0-4	0.00000	0.00000	204,760	191,632	2.04760	1.91632	0.13128
5-9	0.00000	0.00000	204,760	191,632	2.04760	2.02244	0.02516
10-14	0.00000	0.00000	204,760	191,632	2.04760	2.02682	0.02078
15-19	0.01511	0.01511	204,760	191,632	2.04760	2.03030	0.01730
20-24	0.04886	0.06397	178,435	166,818	1.78435	1.77251	0.01184
25-29	0.03459	0.09856	97,910	91,179	0.97910	0.97270	0.00640
30-34	0.01906	0.11762	44,530	41,258	0.44530	0.44226	0.00304
35-39	0.01005	0.12767	17,230	15,864	0.17230	0.17109	0.00121
40-44	0.00333	0.13100	4,105	3,744	0.04105	0.04074	0.00031
45-49	0.00028	0.13128	275	247	0.00275	0.00272	0.00003

D. POLAND (1960-61)

Age groups (1)	Age interval (years) (2)	Order of survival (3)	Number of surviving in a stationary population (4)	Age-specific female fertility rates: For one year (5)	Age-specific female fertility rates: For a period equal to the age interval (6) = (5) × (2)	Cumulative fertility rate (7) = $\sum_{0}^{\omega}(6)$	Number of births per given age group in a stationary population (8) = (5) × (4)	Cumulative fertility rate of a stationary population (9) = $\sum_{0}^{\omega}(8)$
0-4	5.0	1.00000	4.86220	0.00000	0.00000	0.00000	0.00000	0.00000
5-9	5.0	0.94488	4.71930	0.00000	0.00000	0.00000	0.00000	0.00000
10-14	5.0	0.94284	4.71005	0.00000	0.00000	0.00000	0.00000	0.00000
15-19	5.0	0.94118	4.69923	0.04349	0.21745	0.21745	0.20437	0.20437
20-24	5.0	0.93851	4.68325	0.19702	0.98510	1.20255	0.92269	1.12706
25-29	5.0	0.93479	4.66175	0.16102	0.80510	2.00765	0.75063	1.87769
30-34	5.0	0.92991	4.63418	0.09948	0.49740	2.50505	0.46101	2.33870
35-39	5.0	0.92376	4.59850	0.05691	0.28460	2.78965	0.26175	2.60045
40-44	5.0	0.91564	4.54988	0.02096	0.10480	2.89445	0.09537	2.69582
45-49	5.0	0.90431	4.47890	0.00200	0.01000	2.90445	0.00896	2.70478

Age groups (1)	Fall in the number of births in each age group, allowing for the effect of mortality (10) = (6) − (8)	Cumulative fall in the number of births in each age group, allowing for the effect of mortality (11) = = (7) − (9) = $\sum_{0}^{\omega}(10)$	Expected number of births after a given age, without allowing for the effect of mortality (per 100,000 women) (12) = 100,000 $\sum_{\omega}^{0}(6)$	Expected number of births after a given age, allowing for the effect of mortality (per 100,000 women) (13) = 100,000 $\sum_{\omega}^{0}(8)$	Mean expected number of births after a given age per woman, without allowing for mortality (14) = = (12) : 100,000	Mean expected number of births per woman after a given age, allowing for mortality (15) = = (13) : (3)	Fall in the mean expected number of births due to mortality (16) = = (14) − (15)
0-4	0.00000	0.00000	290,445	270,478	2.90445	2.70478	0.19967
5-9	0.00000	0.00000	290,445	270,478	2.90445	2.86256	0.04189
10-14	0.00000	0.00000	290,445	270,478	2.90445	2.86256	0.03569
15-19	0.01308	0.01308	290,445	270,478	2.90445	2.87382	0.03063
20-24	0.06241	0.07549	268,700	250,041	2.68700	2.66423	0.02277
25-29	0.05447	0.12996	170,190	157,772	1.70190	1.68778	0.01412
30-34	0.03639	0.16634	89,680	82,709	0.89680	0.88943	0.00737
35-39	0.02285	0.18920	39,940	36,608	0.39940	0.39629	0.00311
40-44	0.00943	0.19863	11,480	10,433	0.11480	0.11394	0.00086
45-49	0.00104	0.19967	1,000	896	0.01000	0.00991	0.00009

Age groups (1)	Age interval (years) (2)	Order of survival (3)	Number of surviving in a stationary population (4)	Age-specific female fertility rates: For one year (5)	Age-specific female fertility rates: For a period equal to the age interval (6) = (5) × (2)	Cumulative fertility rate (7) = $\sum_{0}^{\omega}$ (6)	Number of births per given age group in a stationary population (8) = (5) × (4)	Cumulative fertility rate of a stationary population (9) = $\sum_{0}^{\omega}$ (8)
0-4	5.0	1.00000	4.89204	0.00000	0.00000	0.00000	0.00000	0.00000
5-9	5.0	0.97603	4.87537	0.00000	0.00000	0.00000	0.00000	0.00000
10-14	5.0	0.97433	4.86872	0.00000	0.00000	0.00000	0.00000	0.00000
15-19	5.0	0.97307	4.86019	0.04559	0.22795	0.22158	0.22158	0.22158
20-24	5.0	0.97085	4.84701	0.19870	0.99350	1.22145	0.96310	1.18468
25-29	5.0	0.96788	4.83098	0.13121	0.65605	1.87750	0.63387	1.81855
30-34	5.0	0.96442	4.81142	0.06410	0.32050	2.19800	0.30841	2.12696
35-39	5.0	0.95991	4.78384	0.02860	0.14300	2.34100	0.13682	2.26378
40-44	5.0	0.95320	4.74264	0.00864	0.04320	2.38420	0.04098	2.30476
45-49	5.0	0.94321	4.67992	0.00051	0.00255	2.38675	0.00239	2.30715

As can be seen from the tables reproduced here, the true rates of natural increase are lower than the actual ones for corresponding years in all the countries except Albania. In Hungary the rate has a negative value. In the countries compared the length of a generation is shortest in Hungary (25.8 years) and Czechoslovakia (25.6 years).

If we take the net rate, then the shorter a generation is, the higher is the true rate of natural increase. Shortening of a generation with a net rate less than unity therefore makes for a faster decline of population numbers, while a net rate higher than unity makes for more rapid growth, as Dr. György Vukovics has also pointed out in connection with analysis of the dynamics of the length of a generation in Hungary.[1]

Table 9 presents the results of our calculations relating to the net reproduction rate (R_0), length of a generation (T), and true rate of natural increase (r), compared with the actual rates of increase.

[1] *Demográfia*, 1967, 2.

SLOVAKIA (1960-61)

Fall in the number of births in each age group, allowing for the effect of mortality (10) = (6) − (8)	Cumulative fall in the number of births in each age group, allowing for the effect of mortality (11) = = (7) − (9) = $\sum_{0}^{\omega}$ (10)	Expected number of births after a given age, without allowing for the effect of mortality (per 100,000 women) (12) = 100,000 $\sum_{\omega}^{0}$ (6)	Expected number of births after a given age, allowing for the effect of mortality (per 100,000 women) (13) = 100,000 $\sum_{\omega}^{0}$ (8)	Mean expected number of births after a given age per woman, without allowing for mortality (14) = = (12) : 100,000	Mean expected number of births per woman after a given age, allowing for mortality (15) = = (13) : (3)	Fall in the mean expected number of births due to mortality (16) = = (14) − (15)
0.00000	0.00000	238,675	230,715	2.38675	2.30715	0.07960
0.00000	0.00000	238,675	230,715	2.38675	2.36381	0.02294
0.00000	0.00000	238,675	230,715	2.38675	2.36793	0.01882
0.00618	0.00637	238,675	230,715	2.38675	2.37100	0.01575
0.03040	0.03677	215,880	208,557	2.15880	2.14819	0.01061
0.02218	0.05895	116,530	112,247	1.16530	1.15972	0.00558
0.01209	0.07104	50,925	48,860	0.50924	0.50663	0.00262
0.06688	0.07722	18,875	18,019	0.18875	0.18772	0.00103
0.00222	0.07944	4,575	4,337	0.04575	0.04550	0.00025
0.00016	0.07960	255	230	0.00255	0.00253	0.00002

The populations of these countries are not, of course, stable, and one cannot assume that the age characteristics of fertility and mortality will remain unaltered in the future over a long period of time. The indices of a stable population, however, allow us to assess the fertility aud mortality conditions existing at the times interesting sn Possessing these indices we can also calculate other characteristics of the corresponding stable population (general birth rate and death rate, age structure, etc.).

It would also be useful to make the same kind of calculations to investigate the problems of marital and extra-marital fertility and of marital fertility by length of marriage.

Such an analysis of fertility by the method of real generations would be of great scientific value, as would a simultaneous investigation of married cohorts and female cohorts by year of birth. The dependence of marital and extra-marital fertility on the total length of marriages of different orders of succession, reduction of the length of marriage during the fertile age for various reasons, etc., are problems whose role needs to be studied further.

Table 4

Length of a Female Generation and True Rate of Natural Increase in the USSR

(Calculated from age-specific data on mortality and fertility for 1958-59)

Age group $(x, x+n)$ (1)	Average age of women in a given age group $\left(x+\frac{n}{2}\right)$ (2)	Number of births in a given age group in a stationary population $\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}$ (3)	$\left(x+\frac{n}{2}\right) \times \left(\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}\right)$ (4) = (2) × (3)	$\sum_0^{\omega}\left(x+\frac{n}{2}\right) \times \left(\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}\right)$ (5) = $\sum_0^{\omega}$ (4)
0-4	2.5	0.00000	0.00000	0.000000
5-9	7.5	0.00000	0.00000	0.000000
10-14	12.5	0.00000	0.00000	0.000000
15-19	17.5	0.13701	2.397675	2.397675
20-24	22.5	0.75677	17.027325	19.425000
25-29	27.5	0.75192	20.677800	40.102800
30-34	32.5	0.50622	16.452150	56.554950
35-39	37.5	0.30328	11.373000	67.927950
40-44	42.5	0.10837	4.605725	72.533675
45-49	47.5	0.02212	1.050700	73.584375*

$R_0 = 1.26182$ $T = 28.458242$ $r = 0.00820487$

* This value is multiplied by the percentage of girls born in order to obtain R_1; the length of a generation (T) is subsequently calculated from the formula $T = R_1 : R_0$.

The true rate of natural increase (r) was calculated from the formula $r = \sqrt[T]{R_0} - 1$, where $R_0 = 1.26182$, $T = 28.458242$; $r = 0.00820487$.

The calculations for the tables that follow were made in the same way.

Table 5

ALBANIA (1960-61)

Age group $(x, x+n)$ (1)	Average age of women in a given age group $\left(x+\frac{n}{2}\right)$ (2)	Number of births in a given age group in a stationary population $\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}$ (3)	$\left(x+\frac{n}{2}\right) \times \left(\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}\right)$ (4) = (2) × (3)	$\sum_0^{\omega} \left(x+\frac{n}{2}\right) \times \left(\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}\right)$ (5) = $\sum_0^{\omega}$ (4)
0-4	2.5	0.00000	0.00000	0.00000
5-9	7.5	0.00000	0.00000	0.00000
10-14	12.5	0.00000	0.00000	0.00000
15-19	17.5	0.28696	5.021800	5.021800
20-24	22.5	1.20138	27.031050	32.052850
25-29	27.5	1.34026	36.857150	68.910000
30-34	32.5	1.12684	36.622300	105.532300
35-39	37.5	0.85783	32.168625	137.700925
40-44	42.5	0.54988	23.369900	161.070825
45-49	47.5	0.24032	11.415200	172.486025

$R_0 = 2.71208$; $T = 30.781997$; $r = 0.03294333$

Table 6

HUNGARY (1959-60)

Age group $(x, x+n)$ (1)	Average age of women in a given age group $\left(x+\frac{n}{2}\right)$ (2)	Number of births in a given age group in a stationary population $\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}$ (3)	$\left(x+\frac{n}{2}\right) \times \left(\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}\right)$ (4) = (2) × (3)	$\sum_0^{\omega} \left(x+\frac{n}{2}\right) \times \left(\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}\right)$ (5) = $\sum_0^{\omega}$ (4)
0-4	2.5	0.00000	0.00000	0.00000
5-9	7.5	0.00000	0.00000	0.00000
10-14	12.5	0.00000	0.00000	0.00000
15-19	17.5	0.24814	4.342450	4.342450
20-24	22.5	0.75639	17.018775	21.361225
25-29	27.5	0.49921	13.728875	35.089500
30-34	32.5	0.25394	8.253050	43.342550
35-39	37.5	0.12120	4.545000	47.887550
40-44	42.5	0.03497	1.486225	49.373775
45-49	47.5	0.00247	0.117325	49.491100

$R_0 = 0.92558$; $T = 25.826184$; $r = 0.00299$

Table 7

POLAND (1960-61)

Age group $(x, x+n)$ (1)	Average age of women in a given age group $\left(x+\frac{n}{2}\right)$ (2)	Number of births in a given age group in a stationary population $\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}$ (3)	$\left(x+\frac{n}{2}\right) \times \left(\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}\right)$ (4) = (2) × (3)	$\sum\limits_0^\omega \left(x+\frac{n}{2}\right) \times \left(\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}\right)$ (5) = $\sum\limits_0^\omega$ (4)
0-4	2.5	0.00000	0.000000	0.000000
5-9	7.5	0.00000	0.000000	0.000000
10-14	12.5	0.00000	0.000000	0.000000
15-19	17.5	0.20437	3.576475	3.576475
20-24	22.5	0.92269	20.760525	24.337000
25-29	27.5	0.75063	20.642325	44.979325
30-34	32.5	0.46101	14.982825	59.961250
35-39	37.5	0.26175	9.815625	69.777775
40-44	42.5	0.09537	4.053225	75.831000
45-49	47.5	0.00896	0.425600	74.256600

$R_0 = 1.31993$; $T = 27.45389$; $r = 0.01009558$

Table 8

CZECHOSLOVAKIA (1960-61)

Age group $(x, x+n)$ (1)	Average age of women in a given age group $\left(x+\frac{n}{2}\right)$ (2)	Number of births in a given age group in a stationary population $\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}$ (3)	$\left(x+\frac{n}{2}\right) \times \left(\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}\right)$ (4) = (2) × (3)	$\sum\limits_0^\omega \left(x+\frac{n}{2}\right) \times \left(\frac{nL_x}{l_0} \times \frac{B_{x,\,x+n}}{P^n_{x,\,x+n}}\right)$ (5) = $\sum\limits_0^\omega$ (4)
0-4	2.5	0.00000	0.000000	0.000000
5-9	7.5	0.00000	0.000000	0.000000
10-14	12.5	0.00000	0.000000	0.000000
15-19	17.5	0.22158	3.877650	3.877650
20-24	22.5	0.96310	21.669750	24.547400
25-29	27.5	0.63387	17.431425	41.978825
30-34	32.5	0.30841	10.023325	52.002150
35-39	37,5	0.13682	5.130750	57.132900
40-44	42.5	0.04098	1.741650	58.874550
45-49	47.5	0.00239	0.113525	58.988075

$R_0 = 1.11897$; $T = 25.567459$; $r = 0.004400625$

Table 9

Net Reproduction Rate, Length of a Generation, and True and Actual Rates of Natural Increase

Country	Years	Net reproduction rate R_0	Length of a generation (in years)	Rate of natural increase	
				actual	true
USSR	1958-59	1.26182	28.5	17.8	8.2
Albania	1960-61	2.71208	30.8	32.4	32.9
Hungary	1959-60	0.92558	25.8	4.5	—3.0
Poland	1960-61	1.31993	27.5	14.9	10.1
Czechoslovakia	1960-61	1.11897	25.6	6.7	4.4

In addition, in our view, there is a need to synthesise the methods of longitudinal and cross-sectional analysis of fertility, on the basis of which a fuller and more correct interpretation of most widely used indices (e.g., general birth rate) would become possible, although the insufficiency of the existing statistics would seemingly present very great difficulties in this field.

Chapter 3

MATHEMATICAL MODELS

A. Y. Boyarsky, D. Sc. (Econ.)

One may call the static or dynamic picture of a population's state and movement determined theoretically on the basis of certain conditions a population model. Some of the initial conditions usually correspond to the actual characteristics of the population at one time or another, and some to an hypothesis; but it may also be that they are all hypothetical. The last case can be illustrated by a simple example: to wit, when it is taken that the initial population is one million and that it doubles every 25 years, so that the whole series by 25-year intervals will be one million, two million, four million, eight million, sixteen million, and so on.

That is a dynamic picture of population growth reflecting Malthus' well-known hypothesis in which not only was an initial population of one million assumed but also the rate of increase itself (Malthus himself thought that it actually existed).

Finally, the elements of the initial conditions (or all of them taken together) can be represented algebraically. If we take it that the population is increasing at an unaltered rate, then its size can be expressed by the following formula:

$$P_t = P_0 (1 + k)^t,$$

where P_t is its size at time t;
P_0 is its initial size, i.e., at $t = 0$; and
k is the annual increment (t may be either a whole number or a fraction).

The algebraic form of the model makes it easier to bring out what follows in general from the hypothesis adopted, since what is defined by the concrete value of one characteristic or another does not hide it in this form.

The population model based on the hypothesis of a stationary population plays an essential role in demographic research. Its conditions are: (1) absence of external migration; (2) maintenance of an unaltered "order of extinction" registered in certain mortality tables[1]; (3) an unaltered density of births (i.e., number of births per unit of time).

From these conditions a picture of the population's size, age and sex composition, and birth and death rates is determined.

It will easily be seen that the size and sex and age composition of a stationary population remain constant. In fact, at time t those born x years before are x years old; but the numbers born x years earlier for any time t are identical by virtue of the unaltered density of births. At time t some persons of age x remain alive in accordance with the second condition of the hypothesis. Thus there is one and the same number of persons of age x at any moment of time.

As for sex distribution, it depends primarily on the sex composition of those born x years before. If it were not stipulated in the conditions that this sex composition is constant, it would have in fact to be assumed.

The proportion of those surviving to age x is not the same for males and females, and the sex composition of those aged x also depends on that; but, when we take it that the "order of extinction" is unaltered, we have in mind not only the general probabilities of surviving to a certain age for a population of both sexes but also their differentiation by sex. Thus at any given moment the number of males and of females aged x will be constant.

It follows from this argument that neither the numbers of each sex and age group nor the total population whose reproduction is governed by these conditions, change.

[1] By "order of extinction" in demography is meant the indices l_x and d_x of mortality tables, which indicate how the numbers of the initial aggregate of those born are reduced by mortality at various ages.

All this can be put into mathematical form: given an unchanged density of N births per annum (with a constant proportion Θ of girls); an "order of extinction" in the form $l^m(x)$ for the male population surviving to age x and $l^f(x)$ for the females.

In the age group from x to $x + dx$ are to be found those born x years ago in the time interval dx, i.e.,

$$Ndx = (1-\Theta)\,Ndx + \Theta Ndx$$

and correspondingly for boys and girls. At a given time t the following will survive:

$$(1-\Theta)\,Nl^m(x)\,dx + \Theta Nl^f(x)\,dx.$$

But if we go over to a one-year age interval from x to $x+1$, then we have the following for that interval:

$$\int_x^{x+1} (1-\Theta)\,Nl^m(x)\,dx + \int_x^{x+1} \Theta Nl^f(x)\,dx.$$

Or if we designate $\int_x^{x+1} l(x)\,dx$ by L_x, called the "numbers of living" (in a "stationary population") in the mortality tables, then the number of males in a one-year interval will be $(1-\Theta)NL_x^m$, and the number of females ΘNL_x^f.

The annual number of births is often taken as unity; then these numbers will be $(1-\Theta)\,L_x^m$ and ΘL_x^f.

And as regards $(1-\Theta)$ male births in a year and Θ female births, it will be L_x^m and L_x^f.

From these indices the total number of living for the age group between x and $x+1$ will be

$$(1-\Theta)\,NL_x^m + \Theta NL_x^f.$$

Let us now introduce the second condition of the hypothesis in the form of a constant "order of extinction" for both sexes taken together, for which the number of survivors aged x should be obtained as the weighted average of the numbers of males and females with weights $1-\Theta$ and Θ, which leads to

$$L_x = (1-\Theta)\,L_x^m + \Theta L_x^f.$$

It is not difficult to see that the total numbers of the age group for x to $x+1$ can be obtained by multiplying

the total annual number of births by the "number of living" common to both sexes.

Now the total number of the whole stationary population can readily be determined:

$$P = NL_0 + NL_1 + \ldots + NL_\omega = N \sum L_x.$$

But $\Sigma L_x = \int\limits_0^\infty l\,(x)\,dx$ is nothing more nor less than the average span of life e_0, which means that the total stationary population is Ne_0, i.e., the annual number of births multiplied by the average span of life.

Let us examine the movement of the population. Since, in the absence of migration, the total population does not alter, the rate of natural increase is $k = 0$.

The birth rate is easily determined as the ratio of the annual number of births to the size of the population:

$$n = N : Ne_0 = \frac{1}{e_0},$$

i.e., a magnitude which is the inverse of the average span of life.

And since $k = 0$, mortality equals natality, i.e., is also a magnitude which is the inverse of the average span of life.

Thus, given the conditions formulated above, the total size of the population and of each age and sex group will be unchanged with an annual replacement (by virtue of births and deaths) of the fraction of the population which is the inverse of the average span of life, which all explains why this population is called stationary.

When the model of a stationary population in its classical form is limited to fixing the "laws" of births and deaths its idea can be developed.

Let us take, for example, the sequence of going to work by age and sex as unchanged, i.e., let us assume that the number of those surviving to age x who have already gone to work is v_x and the number not yet employed is $l_x\,(1 - v_x)$.

By analogy we can determine the number of males beginning work at age x (i.e., between x and $x + 1$) for any moment, using the formula:

$$(1 - \Theta)\,NL_x^m V_x^m,$$

in which V_x^m is the average V_x^m for the time interval x to $x+1$ weighted according to $l(x)$.

The total number starting work will be:

$$\sum_x [(1-\Theta) NL_x^m V_x^m + \Theta NL_x^f V_x^f] = N \sum L_x V_x,$$

where V_x is the corresponding weighted average of V_x^m and V_x^f. Here $\Sigma L_x V_x$ can be looked upon as the average life expectancy of the newborn after starting work.[1]

Let us consider another line of development of the model—nuptiality. If we suppose that the number of males marrying at each age is β_x^m and the number of females β_x^f, then the total numbers marrying in a stationary population annually will be:

$$\sum [(1-\Theta) NL_x^m \beta_x^m + \Theta NL_x^f \beta_x^f].$$

An additional limitation, however, must be remembered, namely, that the total numbers of males and females marrying must be the same, i.e.,

$$\sum (1-\Theta) NL_x^m \beta_x^m = \sum \Theta NL_x^f \beta_x^f.$$

This links the whole series β_x^m and β_x^f together.

The hypothesis of a "stationary population" corresponds to quite limited conditions which are very seldom encountered. The hypothesis of a "stable population" is broader. Its conditions can be represented as the result of the third condition of a stationary population, i.e., constant density of births, or the hypothesis of its changing according to a simple exponential function:

$$N = N(t) = N_0 e^{kt}.$$

In particular, when $k = 0$ the density of births $N(t)$ is transformed into a constant quantity, and the hypothesis of a "stable population" into that of a "stationary population", i.e., the latter is a specific case of a stable population.

Now, in determining the number of persons of age x at time t, it is necessary to remember that the higher the value of x (at a given t), the earlier is their date of birth, which means that the initial numbers of the generations

[1] Not to be confused with the average length of working life or the span of life at working age.

to which the various age groups belong form an "inverted" geometric progression as age increases: when the density of births rises with the common ratio e^k, these starting numbers will diminish with the ratio $1 : e^k = e^{-k}$. All the other previous arguments continue to hold, which means that the numbers of sex and age groups in a stable population must be proportional to the numbers $(1 - \Theta)L_x^m e^{-kx}$ for the male part of the population and $\Theta L_x^f e^{-kx}$ for the female part.

Let us put this in strict mathematical form. In the interval between x and $x + dx$ at time t there will be those born at time $t - x$ in the interval dx. There initial numbers will be

$$N(t-x)\,dx = N_0 e^{k(t-x)}\,dx,$$

and the ratio of boys to girls will be $(1 - \Theta) : \Theta$. At time t (or, what is the same thing, at age x) the following number of males will remain alive

$$(1-\Theta)\,N_0 e^{k(t-x)} l^m_{(x)}\,dx,$$

and a corresponding number of females

$$\Theta N_0 e^{k(t-x)} l^f(x)\,dx.$$

If we single out the part in these expressions depending on t, it will be the factor e^{kt} in both cases. Consequently the numbers of each sex and age group in a stable population are altered, accurate within a constant factor (i.e., proportionally), according to the same exponential function. From that we can already conclude that the relationships between the density of births, the size of the age and sex groups, and, consequently, the total numbers in the stable population do not alter. The whole population, its age and sex groups, and the number of births in it alter in geometric progression with one and the same common ratio, i.e., according to a simple exponential function the variable part of which is e^k.

In order to clarify what these unchanging ratios of the age and sex groups are, let us isolate everything from these same expressions that differentiates them from one another, and which depends on x (i.e., is different as regards age and sex):

$$(1-\Theta)\,e^{-kx} l^m(x); \quad \Theta e^{-kx} l^f(x).$$

Here it is already clear that as age increases the size of the groups diminishes proportionately not only to survival time $l(x)$ but also to the factor e^{-kx}, i.e., with an increase by one year the decline is proportional to the terms of the progression with common ratio e^{-k}.

In order to obtain, for example, the size of the female groups in the age interval of one year between x and $x+1$, we must resort to integration:

$$\int_{x}^{x+1} \Theta e^{-kx} l^f(x)\, dx.$$

The factor e^{-kx} depends here in general on the variable of integration; but it can, just the same, be taken from under the integral sign in the form of its correspondingly weighted mean magnitude. $l^f(x)$ serves as the weight. In fact, leaving aside the constant factor Θ, we have

$$\int_{x}^{x+1} e^{-kx} l^f(x)\, dx = \frac{\int_{x}^{x+1} e^{-kx} l^f(x)\, dx}{\int_{x}^{x+1} l^f(x)\, dx} \cdot \int_{x}^{x+1} l^f(x)\, dx.$$

With one-year intervals, however, $l^f(x)$ changes so little that this weighting can be ignored. And since the interval itself is unity, that means that the fraction at the beginning can be replaced by the integral:

$$\int_{x}^{x+1} e^{-kx}\, dx = \frac{1-e^{-k}}{k} e^{-kx}.$$

The second factor again leads us to L_x^f. Thus the size of a one-year group of the female population is:

$$\Theta \frac{1-e^{-k}}{k} e^{-kx} L_x^f,$$

and the size of a similar group of the male population is

$$(1-\Theta) \frac{1-e^{-k}}{k} e^{-kx} L_x^m,$$

i.e., having discarded the identical constant factor $(1-e^{-k}) : k$, we have established that the numbers of

the male and female groups are proportionate to the numbers:

$$(1-\Theta)\, e^{-kx} L_x^m,$$
$$\Theta e^{-kx} L_x^f.$$

If we pass to the total size of the age groups of both sexes, then by summation we obtain the following for the age interval x, $x+dx$:

$$(1-\Theta)\, e^{-kx} l^m(x) + \Theta e^{-kx} l^f(x) =$$
$$= e^{-kx}\left[(1-\Theta) l^m(x) + \Theta l^f(x)\right] = e^{-kx} l(x),$$

where $l(x)$ (for males and females together) is found by the principle indicated above (see p. 163).

Hence we obtain the following proportional numbers for a one-year group:

$$\int_x^{x+1} e^{-kx} l(x)\, dx \cong \frac{1-e^{-k}}{k} e^{-kx} L_x.$$

And for the total stable population we obtain:

$$\int_0^{\infty} e^{-kx} l(x)\, dx \cong \frac{1-e^{-k}}{k} \sum_x e^{-kx} L_x,$$

or (since it is still a matter of proportional numbers and the constant factor can be disregarded)

$$e^{-kx} L_x \text{ and } \sum_x e^{-kx} L_x.$$

Above, however, we singled out factors dependent on x, leaving aside those dependent on t, and the constant N_0. Allowing for all that we finally obtain the following for the size of the age groups and of the total stable population:

$$\frac{1-e^{-k}}{k} N_0 e^{kt} e^{-kx} L_x,$$
$$\frac{1-e^{-k}}{k} N_0 e^{kt} \sum_x e^{-kx} L_x.$$

Instead of N_0, which refers to a strictly defined initial moment, we may, incidentally, take the number of

births for the actual year between $t = -1$ and $t = 0$ (i.e., for the year ending at time $t = 0$). This figure is

$$\int_{-1}^{0} N_0 e^{kt}\, dt = \frac{1-e^{-k}}{k} N_0.$$

Having designated this number of births for the year as N_{-1}^{0} we may employ the following expression instead of those above:

$$N_{-1}^{0} e^{kt} e^{-kx} L_x,$$

$$N_{-1}^{0} e^{kt} \sum e^{-kx} L_x.$$

As to the number of births in the year ending in general at time t, they are

$$\int_{t-1}^{t} N_0 e^{kt}\, dt = \frac{1-e^{-k}}{k} N_0 e^{kt} = N_{-1}^{0} e^{kt}.$$

The average size of the population for this year is

$$\int_{t-1}^{t} N_{-1}^{0} e^{kt} \sum_x e^{-kt} L_x\, dt = \frac{1-e^{-k}}{k} N_{-1}^{0} e^{kt} \sum$$

(the sense of Σ is obvious from the foregoing).

Hence natality for this year is

$$n = N_{-1}^{0} e^{kt} : \frac{1-e^{-k}}{k} N_{-1}^{0} e^{kt} \sum = \frac{k}{1-e^{-k}} = \frac{1}{\sum_k e^{-kx} Lx}.$$

In this expression there is no element depending on t, i.e., natality is constant in a stable population.

If we do not resort to the method of calculating the size of the population by summating it by one-year intervals, but directly integrate its numbers in the intervals x, $x + dx$, we may then use the following expression to determine the total population:

$$\int_{0}^{\infty} N_0 e^{k(t-x)} l(x)\, dx = N_0 e^{kt} \int_{0}^{\infty} e^{-kx} l(x)\, dx.$$

This expression can be used immediately to find the "instantaneous" or "momentary" natality:

$$n = N_0 e^{kt} : N_0 e^{kt} \int_{0}^{\infty} e^{-kx} l(x)\, dx = \frac{1}{\int_{0}^{\infty} e^{-kx} l(x)\, dx}.$$

This expression does not depend on t, i.e., it remains constant in time; hence, the same number is also the average natality for any year.

As to the rate of natural increase, it will readily be seen that, by interpreting it as the logarithmic derivative of the size of the population, it equals k, since the population grows by a progression with the common ratio e^k.

If the numbers of the population $P(t) = P_0e^{kt}$, then the mean annual population will be:

$$\int_{t-1}^{t} P_0e^{kt}\,dt = P_0e^{kt}\,\frac{1-e^{-k}}{k},$$

and the increment for that year will be

$$P_0e^{kt} - P_0e^{k(t-1)} = P_0e^{kt}(1-e^{-k}).$$

Dividing the second expression by the first we obtain k, as was to be expected, for if the momentary rate of natural increase does not alter it also remains unchanged in the mean for the year.

Knowing natality and the natural increment, the mortality of the population can be determined by a simple subtraction:

$$m = n - k = \frac{k}{1-e^{-k}}\cdot\frac{1}{\sum e^{-kx}L_x} - k.$$

Now let us turn to the sex and age structure of the stable population. The greater k is, the smaller is the size of the older groups in relation to it. With $k = 0$ the structure of a stable population coincides with the structure of a stationary population. With $k > 0$ the stable population is "younger", the size of the groups from 0 to ω diminishing more rapidly than L_x. With $k < 0$ it is "older" because in this case with an increase of the age the factor e^{-kx} increases and the size of groups diminishes more slowly than L_x. It may even happen that it does not diminish in certain intervals, but increases.

These considerations are directly linked with the problem of the "ageing" of population, which has as its source not so much an increase in the numbers of L_x in the older age groups (by virtue of a fall in mortality), as a diminution of k, i.e., of the rates of increase of the population.

The reproduction regime of the population is characterised by the age- and sex-specific death and birth rates. A simple hypothesis that can be adopted as an initial condition in constructing a model is that of an "unaltered reproduction regime". For simplicity's sake we abstract the nuptiality rate, although it too can be included in the concept of reproduction regime in a more general set-up. The methods of analysis in that case, it is true, are complicated to some extent by the need to allow for correspondence of the numbers of men and women marrying, which has already been touched upon.

Stability of a population, it should be noted above all, does not contradict the above hypothesis of an "unaltered reproduction regime".

The general birth and death rates can, in fact, be considered as weighted averages of the age- and sex-specific indices. For characterising the death rate that does not call for any supplementary clarification; but for analysing the facts about natality it must be remembered, above all, that its differential indices relate to the female age groups. Suppose that the birth rate of males is zero. Their total natality will then be zero. In principle the opposite can be done, and we may proceed from data on male fertility, taking the female fertility factor as zero, though we do not know of any examples in practice of this method of calculation being used.

Things are more complicated when the calculation is based on fertility factors constructed on the principle of two separate series, one for males and one for females. The need arises once more to tie the data up, since the total number of children born to all mothers should coincide with the total number of children sired by all the fathers. We have ignored this complication, bearing in mind that the fertility factors are deduced from the data on female fertility.

As regards the weights by which these indices, like death rates, must be "weighted", they are taken from the age and sex structure of the population. In a stable population this structure remains unchanged. Consequently, if the unaltered indices of the reproduction regime are weighted by invariable weights the results should also be unaltered. But if total natality and total mortality do not alter, then the rate of natural increase also does not

alter, and in that case the population grows (or declines) in geometric progression. Then, by virtue of the constant birth rate the numbers of births are altered in a similar geometric progression, and that in fact is a condition of a stable population. The other condition—an invariant "order of extinction"—is absorbed by the condition of constancy of the entire reproduction regime as a whole.

The absence of external migration does not require explanation.

Thus the condition of an invariant reproduction regime does not contradict stability of the population.

How is this tied up more concretely?

In order to obtain an unaltered reproduction regime corresponding to a given stable population it is sufficient to concretise the regime as follows: (1) by including in it the second condition of the hypothesis of a "stationary population", which serves as the basis for the given stable population; (2) knowing the birth rate for this population, by determining the yearly number of births, and after distributing them by any method according to the mothers' ages, by determining the fertility factor for each of them.

From that it will be seen that, as regards fertility, one can construct an infinite set of reproduction regimes corresponding to a given stable population.

It is more interesting to determine the stable population corresponding to a given reproduction regime. As regards the "order of extinction", it is immediately given as part of the reproduction regime, and the job consists, of course, in determining the rate of natural increase, i.e., the quantity k that defines the common ratio e^k for the geometric progression of the growth of the number of births, and so on.

Let us suppose that this k has already been found, and that we have a stable population in which, in the age interval x, $x + dx$ at time t, there are $(1 - \Theta)N_0e^{k(t-x)}l^m(x)\,dx$ males and $\Theta N_0e^{k(t-x)}l^f(x)\,dx$ females. With a fertility $f(x)$ as a function of their age x in the form of the yearly number of births per woman at that age we will have the following total of births:

$$\int_a^b \Theta N_0 e^{k(t-x)} l^f(x) f(x)\,dx,$$

where $f(x)$ for $x \leqslant a$ and for $x \geqslant b$ is zero (a and b being the limits of child-bearing age).

On the other hand, at time t in a stable population by condition the number of children born is $N(t) = N_0 e^{kt}$ (calculated for one year).

Equating the data on density of births obtained in various ways and cancelling them by $N_0 e^{kt}$, we obtain the following equation:

$$\Theta \int_a^b e^{-kx} l^f(x) f(x)\, dx = 1,$$

which expresses the requirement for correspondence of the obtained stable population to the given reproduction regime.

The product $\Theta l^f(x) f(x)$ is often designated by $r(x)$ (or simply by r), known as the reproduction function of the (female) population. The equality obtained is then written in the form

$$\int_a^b e^{-kx} r(x)\, dx = 1.$$

In practice, by analogy with the calculations already applied, the integral here is replaced by the sum

$$\Theta \cdot \frac{1-e^{-k}}{k} \sum_{x=a}^{x=b-1} e^{-kx} L_x^f F_x = 1,$$

where F_x is the mean $f(x)$ in the one-year interval $x, x + 1$. Here, within the one-year interval, as above, we ignore the weighting according to $l^f(x)$ which is particularly insignificant at those ages lying between a and b, when mortality is very low.

Having got this equation, in which the numbers L_x^f and F_x are known from the given reproduction regime, we select such a k as will give a result on the left equal to unity, with the given accuracy. The technical procedure used for this is of no significance, and is invariably linked with the method of successive approximations.

Let us calculate the reproduction regime for the USSR for 1964-65. We have data on sex and age-specific

natality according to five-year age groups for women, and the numbers of "surviving" women for ages which are multiples of five. Having broken the integration down by five-year intervals, we obtain the following expression for each quinquennium after taking the means of l and f (omitting their weighting) and Θ from under the integral sign:

$$\int_{5i}^{5(i+1)} \Theta l f e^{-kx}\, dx = \Theta \bar{l}_i \bar{f}_i \int_{5i}^{5i+5} e^{-kx}\, dx = \Theta \bar{l}_i \bar{f}_i e^{-5ki} \frac{1-e^{-5k}}{k}.$$

For $k < 0.001$ we can calculate $1 - e^{-5k} \cong 5k$. By so doing we obtain:

$$\int_{5i}^{5i+5} e^{-kx}\, dx = \Theta \bar{l} \bar{f}_i\, e^{-5ki} \frac{1-e^{-5k}}{k} = 5\Theta \bar{l}_i \bar{f}_i e^{-5ki}.$$

In order to obtain $\bar{l}_i$ we can use the following method. By taking four successive l_x, namely,

$$l_{5i-5},\ l_{5i},\ l_{5i+5},\ l_{5i+10},$$

we find a parabola of the third order from them and integrate it from $5i$ to $5i+5$. This immediately gives $5l_i$ in the form

$$5\bar{l}_i = \frac{5(l_{5i}+l_{5i+5})}{2} - \frac{5}{24}[(l_{5i+5}-l_{5i+10})-(l_{5i-5}-l_{5i})].$$

As regards $\bar{f}_i$, we take it as equal to the available age and sex-specific birth rates for the relevant intervals. The statistics give $\Theta = 0.487$. In Table 10 the computations of the integrals given above are presented for $k = 5^0/_{00}$ and $k = 4^0/_{00}$. Multiplying the results of the last columns by $\Theta = 0.487$, we obtain 0.9975 and 1.0232.

We have, of course, deliberately selected such values of k for the last two columns as immediately give results close to unity, with one greater and one less than unity. By interpolating between them (linearly, as in logarithm tables) we finally find

$$k = 0.004 + 0.001 \cdot \frac{1.0232-1}{1.0232-0.9975} = 0.0049, \text{ or } 4.9^0/_{00}.$$

Table 10

Age	i	$5l_i$	$\bar{f}_i$ (‰)	$5\bar{l}_i\bar{f}_i$	$5\bar{l}_i\bar{f}_i e^{-0.025i}$	$5\bar{l}_i\bar{f}_i e^{-0.02i}$
15-19	3	4.7925	23.7	113.6	0.1054	0.1070
20-24	4	4.7735	157.6	752.3	0.6807	0.6944
25-29	5	4.7485	138.9	659.6	0.6821	0.5968
30-34	6	4.7180	95.5	450.6	0.3878	0.3996
35-39	7	4.6790	50.9	238.2	0.2000	0.2071
40-44	8	4.6275	20.3	93.9	0.0769	0.0800
45-49	9	4.5875	4.2	19.3	0.0154	0.0161
					2.0483	2.1010

This means that if the given reproduction regime were maintained sufficiently long into the future (or in the past) the population would grow at this rate.

This is, so to say, a stable population rate of increase, ensured by the given reproduction regime. Such a rate can be determined for any regime. To demonstrate that it is sufficient to note that the left-hand side of the equation for the appropriate k is a monotonously diminishing function of this parameter; for $k = -\infty$ it tends to $+\infty$, and for $k = +\infty$ it tends to zero. The unity on the right-hand side lies within the limits between the one and the other.

Now let us consider the model of a constant reproduction regime with an arbitrary initial population. The conditions of this model are logically very simple: there are given a certain initial population with an inherent sex and age structure and a reproduction regime assumed to be invariant from a certain initial moment. As regards the sex and age structure at the initial moment, it may or may not coincide with the structure of the stable population corresponding to the given regime. It may be constituted as the consequence of another regime that operated in the past, or even through the effect of migration, which we take as subsequently excluded.

Let us express the density of the age and sex distribution of the initial population as the function

$$[1-\Theta(x)]\,P_0(x)+\Theta(x)\,P_0(x),$$

in which the first term expresses the density of the age distribution of the male population and the second the

female population: here $P_0(x)$ characterises the age distribution of the initial population of both sexes, and $\Theta(x)$ the proportion of women among persons aged x.

Let us take the part of the initial population corresponding to the age interval x, $x + dx$. The number in it dying in the time interval dt can be determined from the following formula:

$$\{[1 - \Theta(x)]\, P_0(x)\, \mu^m(x) + \Theta(x)\, P_0(x)\, \mu^f(x)\}\, dt,$$

in which μ^m and μ^f are the death rates of the male and female population aged x.

The number of children born is calculated as

$$\Theta(x)\, P_0(x)\, f(x)\, dx,$$

in which $f(x)$ is the female fertility. The proportion of boys and girls born is $\Theta(0)$. In addition one must remember that all those remaining alive will become older by a value dt.

Thus the given conditions predetermine all subsequent changes in the size and age and sex structure of the population. These ratios open the way to constructing a corresponding system of differential equations.

In distinguishing an infinite number of intervals dx in the age structure, however, we would be forced to construct a system of an infinite number of equations. In order to avoid the difficulties associated with that let us consider the age and sex structure by one-year age intervals.

For the one-year intervals $x, x + 1$, we construct indices analogous to those of the "death rate". The distribution of the population within each such interval will be considered to correspond to $l(x)$. The initial numbers in the interval x, $x + 1$ in that case will correspond to L_x, or rather will contain L_x as a factor similar to the factor $l(x)$ in the composition of the density of the age distribution within the interval concerned. For the rest the numbers in a one-year interval—as a whole or in part—are not differentiated.

During the period dt the following numbers die from each term $l(x)dx$:

$$l(x)\, dx \cdot \mu(x)\, dt = -l'(x)\, dx\, dt,$$

and the total number dying in a one-year interval is

$$\int_{x}^{x+1} -l'(x)\,dx\,dt = (l_x - l_{x+1})\,dt = d_x\,dt.$$

The relative number of those dying will be $d_x dt : L_x$, or $d_x : L_x = m_x$ in calculations for the year.

In order to determine the numbers being born it is sufficient to multiply the number of females in the age interval x, $x + 1$ by the mean yearly fertility F_x.

Having designated the age distribution at time t by $P_t(x)$, we construct a system of differential equations, bearing in mind the one-year age intervals, for which we compare the population at time $t + \tau$ with the population at time t. At this moment in age x (i.e., between x and $x + 1$) there will be persons whose age at time t will be between $x - \tau$ and $x - \tau + 1$, excluding those dying. If τ is insignificant, the mortality of persons of this category can be taken as a quantity equal to $m_x\tau$. It is necessary, however, to distinguish the age groups between $x - \tau$ and x and between x and $x - \tau + 1$ for time t in the calculations. If, for that purpose (even though in contradiction of the foregoing), we adopt the hypothesis of an equal distribution within two-year intervals at time t, then we shall obtain an initial number equal to $P_t(x-1)\tau$ for the first of these groups and $P_t(x)(1 - \tau)$ for the second. Excluding the numbers dying we obtain the following for time $t+\tau$ at age x:

$$P_t(x+\tau) = P_t(x-1)\,\tau\,(1 - m_x\tau) + P_t(x)\,(1-\tau)\,(1 - m_x\tau).$$

Opening the brackets and transposing $P_t(x)$ to the left-hand side and dividing both sides by τ, we obtain the expression:

$$\frac{P_t(x+\tau) - P_t(x)}{\tau} = P_t(x-1) - P_t(x-1)\,m_x\tau -$$
$$- P_t(x) - P_t(x-1)\,m_x + P_t(x)\,m_x\tau.$$

With τ tending to zero, we obtain a derivative on the left-hand side; and on the right-hand side we discard the two terms containing τ:

$$P_t'(x) = P_t(x) - P_t(x)\,(1 + m_x).$$

For the age group between 0 and τ at time $t+\tau$ it is necessary, of course, to single out the number of females from the number of the whole population and to calculate the fertility (and correspondingly the figure characterising infant mortality, which may, however, be disregarded when τ is small).

One way or the other, we obtain a system of linear differential equations for the whole aggregate of functions $P_t(x)$. Calculation of the numbers born [or $P_t(0)$] alters nothing; it is expressed linearly through the number of females of fertile age.

The solution of these linear systems can be represented as the sum of a series of items that are either exponential or trigonometric functions corresponding to the real and imaginary roots of the characteristic equation; from which it follows (a) that by the initial conditions of the model, the population will become with time more and more like the population corresponding to the "chief term" of the solution of the system, and (b) that waves may thus be observed in the change in numbers of the separate ages, superimposed on the line of the general trend (corresponding to the trigonometric terms of the solution).

Here the main term of the solution must have one and the same variable part for all x's in the form of an exponential function, being distinguished for the various x's by constant factors. But a population whose groups are being altered according to an exponential function with one and the same coefficient in the exponent (or according to geometric progression with one and the same common ratio) is a stable population (because, with fertility constant, the number of births also varies in geometric progression with the same common ratio). And the fact that such an item does exist in the solution ultimately follows from' the existence of a stable population corresponding to the given reproduction regime.

Thus, as a limit the population in the model being considered approximates to a stable one corresponding to the assigned reproduction regime.

As for the waves originating from the trigonometric terms of the solution (if any), they reflect a rise and fall in the number of births owing to there being either an excess or a shortage of females (compared with a stable

population) in the composition of the population of fertile age.

Something similar is readily noted in all countries whose populations have suffered heavy war losses. In the 1960s a decline in the number of births was observed in them caused by the contingents born during the war having reached fertile age (not to mention other causes here). In the 1970s an increase in the number of births is being noticed by virtue of the fact that those born after the war (whose numbers were greater) are now reaching this age. But we may expect a new fall in the 1980s caused by the low birth rate of the 1960s. In the course of time these waves will become less and less marked.

This is what is known as stabilising of a population. One can say that a stable population resembles the tendency to uniform rectilinear movement in mechanics, which in practice is never completely realised. Just as such movement is proper to a body "left to its own devices", so stabilisation is also a process taking place in a population "left to its own devices", i.e., reproducing itself with one and the same reproduction regime.

In conclusion let us note the following. Let us suppose that the solution of the system of equations examined above can include more than one exponential function as an item. Take the simplest case, when the solution is given as the sum of two such functions. This means that the population of age x can be written in the following form:

$$C_1(x)\,e^{k_1t}+C_2(x)\,e^{k_2t},$$

where $C_1(x)$ and $C_2(x)$ are systems of constant factors for various age groups. Such a population is already, from the very beginning, a unity of two stable populations. By multiplying the age and sex sizes of the population by the fertility factor and adding, we obtain, in fact, the number of births in the following form (for simplicity's sake we consider the population to be uniform):

$$\sum_a^b [C_1(x)\,e^{k_1t}+C_2(x)\,e^{k_2t}]\,F_x=$$

$$=e^{k_1t}\sum C_1(x)\,F_x+e^{k_2t}\sum C_2(x)\,F_x.$$

By adding the number of births, equal to the first item, to the part of the population represented by the same

first item, and the number equal to the second item to the part represented by the second item, we obtain as it were two stable populations.

But two different stable populations cannot constitute a single stable population. Take it, for example, that fertility is $f_1(x)$ and $f_2(x)$ with the given "order of extinction", and the rate of natural increase of the stable population is k_1 and k_2. The total fertility for each age x is formed as the weighted average of $f_1(x)$ and $f_2(x)$ with weights corresponding to the number of women of this age in the one and the other population. But if, in the composition of the one population, their numbers grow proportionately to $e^{k_1 t}$, then they will grow proportionately to $e^{k_2 t}$ in the other. The ratio of the weights is consequently altering all the time in favour of the number of females in that population in which the rate of natural increase is higher.

In that case, however, with $f_1 = f_2$, the mean is changing all the time (approximating to f_1 if $k_1 > k_2$). Formally, the condition of stability is increase of the number of births in geometric progression. When we add two such geometric progressions together we do not obtain a geometric progression. In fact, if the number of births in one stable population is $N_1 e^{k_2 t}$ and $N_2 e^{k_1 t}$ in the other, their sum does not form a geometric progression except in the sole case when $k_1 = k_2$. But that case is degenerated, and there is no need to dwell on it. In the course of time, however, the relative importance of the progression with the smaller common ratio sinks to vanishing point and a single, seemingly stable population again arises.

Let us note that, by taking fertility as equal for both populations, we should (with identical death rates) obtain either identical indices of a stable population

$$(k_1 = k_2;\ C_1 = C_2 = l(x)\, e^{-k_2 x}),$$

or have to recognise at least that one of them is not stable, i.e., that it contains traces of the "waves" about which we spoke above.

These ideas can be applied when considering the structure of a population on any other plane. Let us try and see not only how the transition from one age group to another affects the reproduction of a population, but also the transition to a different group, say, from one social,

occupational or educational group. The tasks arising then have a very direct bearing on the various problems of population mobility.

In this case models of a simple and rigorous form are used, given a matrix of transition probabilities, which may also be differentiated by age. It should be noted at the start that such simple models treat the "transitions" as phenomena mutually independent, which they are not, of course.

Nevertheless, by using simplified models we can obtain very interesting approximate conclusions.

Here we must note that the stochastic moment is often ignored in the calculations, and that we operate with probabilities as with simple conversion factors. The possibility of doing so comes from the fact that very many aggregates are the object of study in demography.

Consider Table 11, which reflects the probability of a person moving in the course of ten years from country to city, from city to country, or of not changing place of residence at all.

Table 11

Probability of Resettlement

	Probability of moving	
	to the country	to the city
From the country	$1-p$	p
From the city	q	$1-q$

Furthermore, let the initial population be P_v in the country areas (villages) and P_c in cities. Then, if the natural movement of the population is left out of account, the number of inhabitants will be as follows in ten years' time:

$$\text{in the country } P_v(1-p)+P_cq,$$
$$\text{in the cities } P_c(1-q)+P_vp.$$

If migration is not to lead to changes in the distribution of the population, these numbers must coincide with the initial ones, i.e.,

$$\begin{cases} R_v(1-p)+P_cq=P_v \\ P_c(1-q)+P_vp=P_c. \end{cases}$$

From these equations we obtain $P_v p = P_c q$. This relationship is obtainable, moreover, from any equation. There is nothing surprising in that; since we have excluded natural movement of the population and emigration, the total population will be unchanged with any flows, and when the urban population has been defined the rural population will also be thereby defined. Consequently the equations are equivalent. The relationship can be represented as a proportion

$$P_c : P_v = p : q.$$

When a population is so distributed then, preserving the assumed probability of migration, there will be no subsequent change in the ratio of the urban and rural populations. If, for example, $P_c < P_v \frac{p}{q}$, then after another ten years the urban population will be bigger than it was by the following amount:

$$P_v p - P_c q = q\left(P_v \frac{p}{q} - P_c\right) > 0.$$

Conversely, if $P_c > P_v \frac{p}{q}$, the difference will be less than zero. Thus the dynamics of the population will always tend to approximate the proportion, on whose reaching stability will be established.

But for that to happen the transition probabilities would have to be maintained, and also the above-mentioned independence of the transitions as stochastic events. Exercises with mathematical models, using them to demonstrate the probability of a scion of the proletariat becoming a rich man in twenty generations, or very nearly a multimillionaire, are therefore pointless; but we have found such exercises in Western research into social mobility.

Nevertheless, given certain conditions, simple models can be used for practical purposes. They will prove more valuable if, when they are compiled, natural population movement and age (which we ignored in our simple example above) are taken into account together with the passage of population from one group to another. Suppose that we have the data on mortality and natality by ages, taken for simplicity's sake as invariable. Let us select a special

group from the entire population, assuming that the probability of persons not belonging to this group joining it in the course of a year at age x (bearing in mind those surviving) is W_x. Suppose also that the reverse transition is impossible. Let A_{xt} designate the number of persons aged x outside the given group at moment t and B_{xt}— the number of such persons in the given group. If the age-specific mortality is the same, then

$$B_{xt} = A_{x-1,\ t-1}(1-m_{x-1})W_{x-1} + B_{x-1,\ t-1}(1-m_{x-1}).$$

If no one is in the group from birth, then

$$A_{0,\ t} = \sum_a^b (A_{x,\ t-1} + B_{x,\ t-1})\, n_x;\ \ B_{0,\ t} = 0,$$

where n_x is the number of births per person among the persons reaching age x by the end of the year (allowing for mortality).

If the age composition of the population has already been stabilised, then

$$A_{xt} + B_{xt} = N_0 e^{h(t-x)} L_x.$$

Supposing further that $1 - m_x = q_x$ and $B_{xt} : (A_{xt} + B_{xt}) = \beta_{xt}$, after cancellation and allowing for $1 - m_{x-1} = L_x : L_{x-1}$ we obtain:

$$\begin{cases} \beta_{xt} = (1-\beta_{x-1,\ t-1})W_{x-1} + \beta_{x-1,\ t-1}, \\ \beta_{0,\ t} = 0, \end{cases}$$

and moreover

$$A_{0,\ t} = L_0 e^{ht}.$$

Hence

$$W_{x-1} = \frac{\beta_{xt} - \beta_{x-1,\ t-1}}{1-\beta_{x-1,\ t-1}}.$$

Now suppose that the population has already been stabilised as regards the proportion of the group interesting us. Then

$$\beta_{xt} = \beta_{x,\ t-1},$$

therefore we can write the expression without t:

$$W_{x-1} = \frac{\beta_x - \beta_{x-1}}{1-\beta_{x-1}}.$$

Having assigned values of β_x we can derive such values of W_x from this expression as will ensure (after a period sufficient for stabilisation) achieving and maintaining the required values of β_x.

Let us take it, for example, that β_x is the proportion of doctors. Their total fraction in the population will be obtained as a weighted average

$$\beta = \frac{\sum \beta_x L_x e^{-kx}}{\sum L_x e^{-kx}}.$$

It will readily be noted that this is the well-known inverted index of population per doctor. Ignoring the different mortalities of the given group and the rest of the population we may, for example, take the value of $\beta_0 = \beta_1 = \ldots = \beta_{23} = 0$; then certain values, not equal to zero, for $\beta_{24}, \ldots \beta_{28}$, and then $\beta_{29} = \beta_{30} = \ldots$. Then all values of W_x, not equal to zero, will be reduced to

$$W_{23} = \beta_{24};\; W_{24} = \frac{\beta_{25} - \beta_{24}}{1 - \beta_{24}};\; \ldots\; W_{27} = \frac{\beta_{28} - \beta_{27}}{1 - \beta_{27}}.$$

Taking a certain index of the provision of doctors β, and having established the values of $\beta_{24}, \beta_{25}, \ldots$ necessary for that, we can determine all values of W_x. In practice their sense is that they immediately show what fraction of all the persons of a given age must train as doctors at that age. Hence, allowing for a certain sifting out during training, one can determine that fraction of the total numbers of the appropriate age groups which should be accepted by medical institutes.

In this case we avoid the wave-form changes in the enrolment of students inevitably associated with an empirical approach. Thus the problem of reducing the intake of students when the number of doctors is greater than what had been planned disappears, or alternatively that of increasing the intake steeply when there are not enough doctors. The establishing of a certain percentage enrolment in teaching establishments from each rising generation makes for stability in the development of the education system. Its advantages need no explanation. One has only to remember that the desired result is only obtained after a certain period of stabilisation of the population.

A population can be considered as an aggregate of families of different types as well as an aggregate of people. There are single persons, families without a married couple, or with one or two married couples, and so on. Each such group may consist of various subgroups according to the size and the age and sex composition of the families. If we distinguish only three age groups in the last subgroup, viz., children, adults, and the elderly (taking persons of fertile age as adults), quite a few types of family are already obtained.

It is obviously necessary to differentiate several main types of family, considering the remainder as "others". We shall limit ourselves to families containing not more than five persons. Their differences in number of adults can then be shown as in Table 12 (excluding families consisting only of children).

Table 12

Composition of Families by Number of Persons

	Adults	Elderly	Children		Adults	Elderly	Children
	1	—		**	4	—	
	—	1	up to 4	*	3	1	
*	2	—		*	2	2	1
	1	1			1	3	
	—	2	3		—	4	
*	3	—		**	5	—	
*	2	1		**	4	1	
	1	2	2	*	3	2	—
	—	3		*	2	3	
					1	4	
					—	5	

Taking the various possible numbers of children into account, we can distinguish 50 types of family. It is necessary, furthermore, to differentiate those who are married among the "adults". If it is also assumed that a married couple must obligatorily be in one family, and that only married couples in which both spouses are of fertile age are considered, then those lines of the table marked with one asterisk (*) may or may not be married couples, while those marked with two asterisks (**) may contain one or two married couples, or none at all. This

increases the number of family types to 74. Adding in the group of "others", we have 75 types.

In order to simplify consideration of all the transition probabilities, it is convenient to apply the principle of "ordinariness", i.e., to consider the transition of families to another state in quite a short interval of time τ during which one may in practice consider it impossible for two events altering the structure of the family to occur, e.g., the birth of two children (leaving aside multiple births).

If for simplicity's sake we also abstract divorces and the marriages of elderly persons, and the birth of children out of wedlock, then the changes designating the transition of a family from one type to another may consist of (1) the birth of a child; (2) the death of a child; (3) the death of an adult (married or not); (4) the death of an elderly person; (5) the marriage of an adult; (6) the passing of a child into the "adult" category; (7) the transition of an adult (married or not) to the "elderly" group.

The yearly probabilities of the relevant events can be determined as follows. The birth of a child, i.e., marital fertility, given two married couples, is twice as probable. Deaths—given the mortality—should be differentiated into three age groups multiplied by the number of persons of the relevant group in a given family, and summated. For that it is necessary to allow separately for the fact that the death of a married adult means at the same time the elimination of a married couple. The probability of a person's marrying is determined by the nuptiality factor, multiplied by the number of adults who are not married. Finally, the transition to a higher age group must have a probability corresponding to the density at the right-hand end of the age distribution of the given group. Roughly speaking, if we take the upper limit of the "child" group as sixteen, the probability of a child passing into the higher group can be taken as the proportion of 15-year-olds in the "child" group. More exactly, one should take the proportion among the age group of those between $16 - \tau$ and 16, divided by τ. If it is taken that the population as an aggregate of people has achieved stability, this probability will be

$$\frac{1}{\tau} \int_{16-\tau}^{16} le^{-kx}\,dx : \int_{0}^{16} le^{-kx}\,dx.$$

If it is taken that the principle of ordinariness can be applied without loss of rigour only when $\tau \to 0$, then the limit of this probability will be

$$l_{16}e^{-16k} : \int_0^{16} le^{-kx}\,dx.$$

This probability, of course, must also be multiplied by the number of children (or correspondingly of adults). If it is a matter of married adults then it is necessary to allow for the disappearance of married couples capable of having children, as a consequence of the ageing of one of the spouses.

Finally, it is necessary to take into account the complications in the computations associated with marriages. (1) The indices must be so constructed that the number of families in which marriages occur is necessarily even. (2) The model must be supplemented by a condition of the formation of new families from married couples. The simplest hypothesis would be that according to which all newly-weds quit their former families in order to form a new one consisting of two persons (one married couple).

All the probabilities directly given for one year must be multiplied by τ, since the principle of ordinariness would otherwise be excluded. Then the number of families of each type can be represented as a linear function of the number of families of various type τ time ago.

Let us take several examples so as to avoid having to write 75 such functions. Let us designate marital fertility by f, child mortality by m_c, adult mortality by m_a, elderly mortality by m_e (without differentiation by family status, although that does not present any great difficulty), marriage by h (in the sense indicated above), the probabilities of a transition to a higher age group by v_c and v_a. All the probabilities relate to one year.

The probability of a family consisting of a married couple and one child becoming one with two children is f. The probability of a family consisting of two married couples becoming one with two couples and a child is $2f$. For families consisting of two married couples and a child this $2f$ is the probability of its passing into the "others" group. For families consisting of a married couple, two adults, and a child, the probability of its becoming a fami-

ly consisting of a married couple, one adult, and a child is $2h + 2m_a$ (either through one of the adults marrying or dying). For this same family the probability of its becoming one with a married couple and two adults is m_c, or a family consisting of three adults and a child is $2m_a$ (through the death of one of the spouses).

The probability of the same family becoming one with a married couple and three adults is v_c, or a family with a married couple, one adult, one elderly person, and a child, or one with three adults, an elderly person, and a child is $2v_a$ (through the ageing of one of the spouses), and so on.

Special allowance must be made for families consisting of one married couple only. The number of such families in time τ will be equal to the number already existing multiplied by the probability of their remaining so (which is $1 - 2m_a - 2v_a$), plus the number of such new families formed during time τ. The number of the last will be half the total number of the unmarried adults multiplied by the nuptiality factor h. We get the total figure for such adults by adding up the products of their number in families of different types by the appropriate number of families.

Knowing these probabilities and the number of families of different types, we can calculate the number of families of each type after time τ. Equating the relative number of families of each type at the end of this period to their number at the beginning and taking these relative numbers as unknowns, we determine the stable family structure of the population corresponding to the given probabilities and conditions of the model as a whole. In that way we can also calculate the stable composition of the population by the three age groups distinguished (children, adults, and elderly), and on that basis can determine the natality, mortality, and natural increase for the population as a whole.

The sole difficulty that may arise here comes from the "other" group of families, since they can pass into any kind of family consisting of five persons. But if bigger families (i.e., the "others") are sufficiently rare, we can adopt any norms for these transitions without danger of error in the results.

The given model can be of great practical significance, for example, in solving problems of housing construction.

The architecture of blocks of flats that are to last for several decades cannot be calculated on the transient features of the family structure of the population. It should be oriented on the most stable relationships, which may be taken as those corresponding to a stable population structure, although the actual existing structure may differ in a marked way from it. The model for this, of course, has to be devised allowing for several details that we have deliberately ignored, standards for the distribution of newly-wed couples in new families, and for the extension of already existing families, more differentiated indices with a larger number of age groups (or rather of age and sex groups), and finally migration. But the basis of the method of building the model is the same.

The mathematical model of a stable population is of great theoretical and practical importance. Its theoretical value is that it enables us to characterise the structure of the population and make a quantitative estimate of changes in its size from a concrete preset reproduction regime irrespective of the actual structure of the population, i.e., it can be used to analyse the reproduction regime in "pure" form. Its practical value is its application as the initial premise for concrete calculations, when it seems inadvisable to base ourselves on the population's structure existing at the present moment or at any time in the not so distant future, which is inevitably transitory.

The model, however, also has several limitations, which must be taken into account when tackling the problem of determining the size and composition of a population in the long-term perspective. The limitations spring from the conditions "stipulated" in it, namely, maintenance of a certain given reproduction regime over an undetermined time in the past and future, which has as its result immutability of the population's structure in time and constancy of its rate of increase.

It is hard to imagine that the actual structure, being the result of natural movement, migratory processes, and socio-economic processes in the past, would be adequate to the structure of a stable population meeting all the requirements of the regime noted at the moment when the actual structure was determined. In other words, it is difficult to imagine immutability of the reproduction regime in the

past; and it is just as difficult to accept this condition in the future.

In order to estimate the size and composition of a population in the immediate future, it is hardly justified, consequently, to start from the parameters of the regime conditioning the structure of a stable population, as well as from the structure itself, since the former must be considered transitory. For that purpose we must use a mathematical model making it possible to treat the reproduction process as a transition from the actual structure to a hypothetical (calculated) reproduction regime changing with time.

The models underlying new methods of long-term calculation of a population's total size and sex and age composition treat the reproduction process not only as the interconnection and interconditioning of mortality and natality but also of nuptiality and the stability of marriages. In general the last two processes have not been allowed for in recent years, or have been taken as obvious, for the simple reason that researchers' attention has been concentrated on the processes of natality and mortality as factors directly determining reproduction. The inclusion of the processes of nuptiality and marriage stability in the general scheme of the reproduction processes has become an objective need of the day, the consequence of the tendency for maximum approximation in modelling demographic processes to their real course in the population.

At present, in connection with the growing role of long-term calculations of the size and sex and age composition of the population, and with the heightening of demands on their accuracy and with the increasing volume of information, the number of techniques for making them has also increased.

Almost all long-term calculations made earlier (in the 1950s) were very rapidly proved wrong. That stimulated the development of more far-reaching methods of investigating demographic processes and more developed schemes of long-term calculation aimed at its subsequent improvement.

The simplest method of calculating the future size and composition of a population, and that most widely adopted, is the method based on coefficients of "survival" and age

fertility factors. Examples of calculations made by this method are the long-term estimates of the Soviet population, and most of the similar calculations being made in other countries at the present time. The progress made in the modelling of demographic processes is making it possible to employ this method of long-term calculations even in countries where the current statistics needed are not available, or are unreliable.

The most problematic aspect of long-term calculations is the determination of future births by separate calendar periods. This is due to the fact that fertility is at present the most essential and potentially the most dynamic factor in altering a population's total size and age and sex structure. That is why improvement of the techniques of long-term calculation mainly concerns determination of future numbers of births; this has taken two lines, one of which envisages employing a system of indices of the reproduction regime calculated by the methods of hypothetical generations, and the other by the method of real generations.

In the models underlying the new, more detailed methods of estimating future births, fertility is considered (in both the hypothetical and the real generation method) not only as a function of age but also of family status, length of marriage (for the married), the number of children already born, the interval between marriage and the birth of a child, and between successive births.

The simplest approach to calculating future numbers of births by the real generation method can be taken as the cohort technique by period or year of birth. In calculations by the hypothetical generation technique the fertility of a definite age group in a given calendar period is not considered to depend on the fertility of this same group in the past (or rather it finds only "indirect" reflection in the index for the period concerned). In contrast to that, the whole history of child-bearing is considered directly in the cohort method. The fertility factor calculated by the hypothetical generation method is inadequate to bring out the trend of fertility, as it is subject to the effect of random variations of fertility, while indices calculated by the cohort method make it possible to "refine" the general trend of chance variations.

The initial data for calculating the number of future

births by the cohort method are the indices of cumulative fertility (the summated numbers of births at definite age or year of marriage) and the presumed final (exhausted) fertility of women of different cohorts. In determining the presumed final fertility, we can use data on the dynamics of the indices of final fertility of the cohorts of females no longer in the period of fertility, the data of polls on the number of children desired, and extrapolated indices of cumulative fertility. The difference between indices of cumulative fertility at the beginning of the calculations and of the presumed final fertility gives the average number of children that will be born by the women of the given cohorts during the period covered by the calculations. To distribute this average number of children by the years covered by the calculations, various information is employed, namely, the age distribution of women at the birth of children in cohorts with an ended period of fertility; coefficients of age-specific fertility for several calendar years; the proportions of children born to women at a given age in various cohorts.

At present, in order to validate the trend of the birth rate more adequately in the long term, more far-reaching researches are being employed, starting from a developed system of indices of the statistics of natural movement. Only countries with very full statistics have the requisite indices at their disposal. It is therefore not fortuitous that work is being done in these countries to improve the methodology of long-term calculation of the total population and of its age and sex composition.

The advantages of one method or another of forward calculations of future numbers of births are still difficult to evaluate, especially as regards long-term estimates.

The fact, however, that several models start from a complex of indices of the reproduction regime that are altered only by living conditions, and also from the probability of an increase in the size of families, and from the number of births and the time interval since the previous birth, gives grounds for hoping for improved accuracy in short-term calculations,

Chapter 4

ECONOMIC AGE PYRAMIDS

Doctor E. Valkovics (Hungary)

A synthetic picture of the changes taking place in the age structure of a population can be obtained by means of economic age pyramids. These demographic changes, in fact, have a number of favourable and unfavourable consequences, measurement of which often presents insuperable difficulties. The often described unfavourable economic consequences of a fall in the birth rate and of the "ageing" of the population stemming from it are, for example, an increase in expenditure to maintain the growing elderly fraction of the population, a reduction over a certain period of the fraction of people of active, independent age, and a lowering of areal and social mobility. Economically favourable factors are a reduction in expenditure on educating young people, an increase in women's opportunities of finding work, and an increase in per capita fixed and circulating assets.

Until recently demographers and economists could not take these favourable and unfavourable effects into account and compare them so as to say whether the outcome of the changes taking place in a population's age structure was favourable or unfavourable. The purpose of economic age pyramids is to make good the absence of this kind of synthesis. In most cases they are calculated by multiply-

ing the age intensities and correspondingly the scale of various economic phenomena [1] (economic activity and inactivity, working and non-working or leisure time, production, consumption, incomes, savings, etc.) characteristic of the "average man" [2] (i.e., of the representative of the population of separate age groups) by the numbers of the population of the relevant age groups.

Thus economic age pyramids express the joint economic effect of the size and age structure of a population and correspondingly of the age-specific intensity or scale of the relevant economic phenomena.

By using economic age pyramids calculated for several time intervals by the standardisation method, we can bring out the economic effect of the population's size and age structure and of the age-specific intensities or magnitudes of the relevant economic phenomena (or the economic effect of just two factors), given invariability of the other two (and correspondingly of a third factor).

Economic age pyramids make it possible to clarify the economic effect of the changes taking place in a population's size and age structure. They are also useful for estimating the impact of alterations in the intensity and correspondingly in the scale of the economic characteristics of the "average man" in the separate age groups on the economy.

Such pyramids have been developed in the Demographic Research Institute of the Hungarian Central Statistical Board for the economically active and inactive population, for working and non-working (leisure) time, and for production and consumption in 1948-49 and 1959-60 (see Fig. 1).

Pyramids for Hungary's population in 1980-81 were also calculated (from preliminary data), using variant F/1 of our calculations of the prospective size of the population, and of the intensities and scales of the economic

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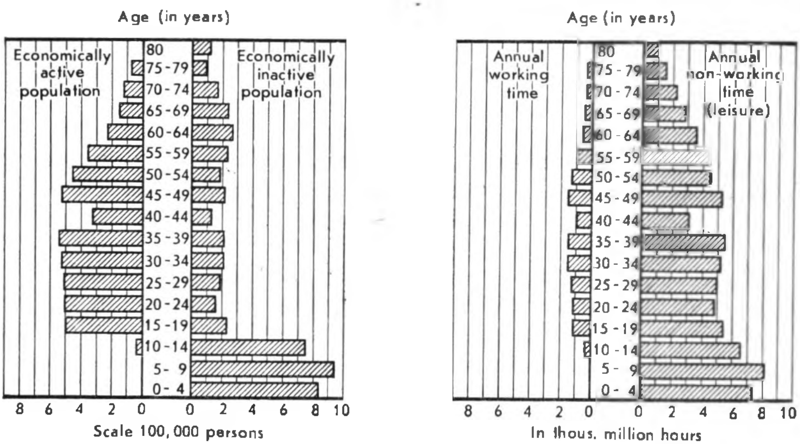
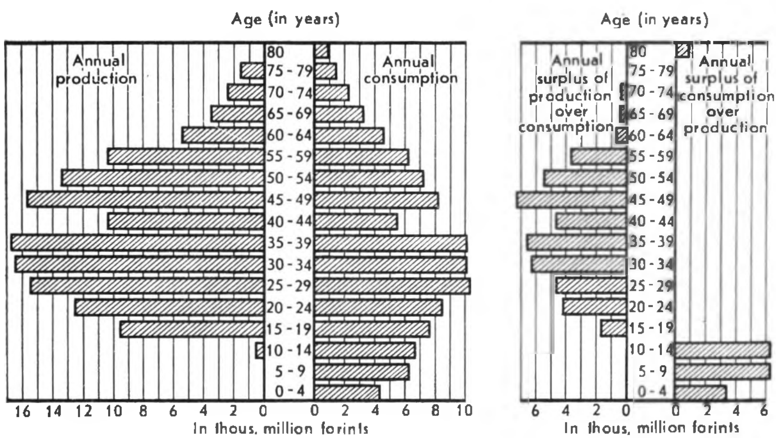
[1] The author has in view concepts generalising the characteristic of various economic phenomena, such as production and consumption, working and leisure time, etc., for analysing which the method described is useful.

[2] By "average man" is understood a person whose intensity of all social and demographic processes corresponds to their intensity obtained for the whole population of a country or region.

Economic Age Pyramids of the Hungarian Population for 1959-60



characteristics for 1959-60 specific to the separate age groups, in order to compute the economic effects of changes in the size and age structure of the population to be expected in the future. The publications presenting and



(in 1959 prices)

Fig. 1

interpreting the results of the calculations also described the methods by which they were calculated, allowing specially for the age intensities and scales of the economic phenomena.[1] By means of the standardisation method described earlier we also investigated the role of changes in the population's size and age structure, and the age intensities and corresponding scales of the economic characteristics of the "average man" in Hungary in 1948-49 and 1959-60.

We think it is of paramount importance for science to deepen this analysis and extend it as far as possible to other periods of the development of the economy.

In addition to economic age pyramids of the actual population we also constructed them for "model" populations, both stationary and stable. The simplest case of a stationary population is that of mortality tables (L_x). Our stationary economic age pyramids were therefore calculated first as tables of a stationary population calculated for both sexes from the Hungarian mortality tables for 1948-49 and 1959-60, and were computed by multiplying the numbers of the stationary population of the separate age groups by data characterising the age intensities and correspondingly the scales of the relevant economic phenomena.

A very important moment in the compilation of what we call economic mortality tables is the calculation of working and non-working (leisure) time, production, consumption, and the preponderance of production or consumption obtained as a result of calculating the economically active and inactive stationary sub-population.[2] By accumulating the data of the economic age pyramids for the stationary population of the mortality tables from below, we obtained the magnitude of the total length of economically active life ($T_{f,x}$) expected at age x, the total length of economically inactive life ($T_{i,x}$), ($T_{m,x}$), the total amount of non-working time (leisure) ($T_{i,x}$), the total product ($T_{p,x}$), the total consumption ($T_{c,x}$), and the total

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[1] E. Valkovics. Derived Economic Age Pyramids of Hungary's Population, *Demográfia*, 1966, 9, 4:507-24; 1967, 10, 3-4:469-93. E. Valkovics. Economic Age Pyramids of Hungary's Population, *Központi statisztikai*, Hivatal. Népességoudományi Kutató Csoport, Budapest, 1967, 17.

[2] By "sub-population" we mean that part of a population distinguished by some one attribute or another.

preponderance (surplus) of production over consumption ($T_{p(+)c(-)x}$). By dividing the last by the appropriate value of the "order of survival" (l_x) of the table, we obtain the average scale per capita of these economic phenomena expected at age x.

What use can be made of stationary economic age pyramids? In particular, they can be used to clarify what these pyramids would be if the death rate, age structure of mortality, age intensities and correspondingly sizes of the economic characteristics of the "average man" remained constant at the level typical of a definite period. In order to get an idea of the potential economic significance of this process, the stationary age pyramids can be compared with the actual ones of the appropriate years. But the comparison is impossible if we start from age pyramids of the stationary population, since an identical arbitrary number of births ($l_0 = 100{,}000$) was used in building them. The pyramids do not therefore express absolute relations, but only characterise internal proportions. Comparison is only possible for such stationary economic age pyramids as are constructed starting from the actual number of births characteristic of the relevant years. We therefore calculated such pyramids.

In a stationary population the yearly number of births and deaths, of course, equal unity, i.e., the difference between them is zero:

$$l_0 = 1; \quad \int_0^{\omega} d_x \, dx = 1.$$

The total stationary population can be determined as the product of the yearly number of births (deaths) by the average life expectancy at birth. The stationary population can consequently be determined the same way as the population in which, in a period of time corresponding to the average life expectancy, as many persons will be born and die as will maintain the total population.

In a stationary population the number of births and deaths, however, is also identical at any other period. The difference between them at any time is zero. Thus, for a stationary population in which the age intensity of the economic characteristics is unchanged, it is characteristic that in the course of time

—corresponding to the expected length of economically active life as many persons will be born or die as the numbers of the economically active "stationary population";

—corresponding to the expected average length of economically inactive life as many persons will be born or die as the numbers of the economically inactive "stationary population";

—corresponding to the expected "average working time" expected at birth such a number of persons will be born or die as would have to spend all their lives as working time (this would be the "permanent stationary working population") so as to ensure the total working time, total production, etc., without involving other inhabitants;

—corresponding to the expected "average non-working time" or leisure such a number of people will be born and die as would spend all their lives as non-working time (leisure).[1]

Given these conditions, the number of births and correspondingly the number of deaths would reach the numbers of the economically active stationary population who ensure a constant volume of production over a period of time equal to the length of economically active life. The number of births and correspondingly of deaths in a period of time corresponding to the general expectation of life at birth would equal the numbers of the total "stationary population" ensuring an unaltered volume of consumption.

Finally, it will easily be seen that in any part of a "stationary population" that is in turn also economically stationary, the number of those falling out after a certain period of time is equal to the number coming in, since otherwise it could not remain stationary.

Our stable economic age pyramids (see Table 13) give an idea of what age distribution of the population and of economic phenomena would come about after a certain time if the age intensities and correspondingly scales of the economic characteristics of the "average man", and the age characteristics of fertility and mortality, remained at the level of 1948-49 and 1959-60. We established, in particular, that when the pyramids are stable, the so-called true rate of natural increase (intrinsic rates)

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[1] This would be the "never working stationary population".

Table 13

Economic Age Pyramids for Hungary in 1959-60

Age group	Size of the population on 1 January 1960 by separate age groups: Total	Economically active	Economically inactive	Annual working time (in years)	Annual working time (in hours)	Annual non-working time (leisure) (in years)	Annual non-working time (leisure) (in hours)	Annual production (in millions of forints)	Annual consumption (in millions of forints)	Surplus of production over consumption* (in millions of forints)
0-4	827,848	0	827,848	0.0	0	827,848.0	7,251,948,480	0.0	4,139.2	—4,139.2
5-9	915,036	0	915,036	0.0	0	915,036.0	8,015,715,360	0.0	6,130.7	—6,130.7
10-14	786,569	36,425	750,144	8,742.0	765,799,200	777,827.0	6,813,764,520	448.0	6,677.4	—6,229.4
15-19	753,491	495,595	257,896	118,942.8	1,041,938,928	634,548.2	5,558,642,232	9,614.5	7,761.0	+1,853.5
20-24	678,963	507,389	171,574	121,773.4	1,066,734,984	557,189.6	4,880,980,896	12,683.1	8,419.1	+4,264.0
25-29	722,496	530,112	192,384	127,226.9	1,114,507,644	595,269.1	5,214,557,316	15,214.2	10,403.9	+4,810.3
30-34	753,716	553,715	200,001	132,891.6	1,164,130,416	620,824.4	5,438,421,744	16,611.5	10,099.8	+6,511.7
35-39	753,751	554,339	199,412	133,041.4	1,165,442,664	620,709.6	5,437,416,096	16,796.5	10,100.3	+6,696.2
40-44	451,622	333,191	118,431	79,965.8	700,500,408	371,656.2	3,255,708,312	10,162.3	5,509.8	+4,652.5
45-49	715,041	518,215	196,826	124,371.6	1,089,495,216	590,669.4	5,174,263,944	15,442.8	8,151.5	+7,291.3
50-54	649,238	456,195	193,043	109,486.8	959,104,368	539,751.2	4,728,220,512	13,320.9	7,401.3	+5,919.6
55-59	580,612	350,925	229,687	84,222.0	737,784,720	496,390.0	4,348,376,400	10,141.7	6,385.0	+3,756.7
60-64	482,400	220,578	261,822	52,938.7	463,743,012	429,461.3	3,762,080,988	5,426.2	4,920.5	+505.7
65-69	348,926	145,230	203,696	34,855.2	305,331,552	314,070.8	2,751,260,208	3,456.5	3,210.1	+246.4
70-74	263,557	108,081	155,476	25,939.5	227,230,020	237,617.5	2,081,529,300	2,356.2	2,161.1	+195.1
75-79	168,684	66,243	102,441	15,898.3	139,269,108	152,785.7	1,338,402,732	1,444.1	1,383.2	+60.9
0-X	109,094	0	109,094	0.0	0	109,094.0	955,663,440	0.0	894.6	—894.6
Total:	9,961,044	4,876,233	5,084,811	1,170,296.0	10,251,792,960	8,790,748.0	77,006,952,480	133,118.5	103,748.5	+29,370.0

* in 1959 prices

indicating the annual growth or correspondingly the annual reduction of the stable population (r) would at the same time show the annual increase or correspondingly annual decline in the aggregate of economic characteristics. Then the change in the same direction and the same proportion would also be effective as regards another period of time, e.g., the period equal to the length of a demographic generation (T). Not only would the size of the population, and the number of births and deaths change in accordance with the net reproduction rate (R_0), but also the aggregate of economic characteristics. Finally, the change in the magnitudes of the economic characteristics and correspondingly in the functions of the economic characteristics of the population in different age groups would have the same trend and tempo, and so too would their total magnitudes and functions, i.e., not only would the age structure of the population be unchanged but also the age distribution of the aggregate of economic characteristics and the population's economic functions.

In connection with developing stationary and stable economic age pyramids we analysed the economic phenomena occurring under the impact of demographic reproduction. We established as a preliminary that the "net reproduction rate" is equally useful for measuring reproduction of the number of births and the size of the population in a stable (stationary) population only. In other cases one must use the index of the number of survived years proposed by L. Henry[1] to measure changes in the reproduction of the numbers of the population.

Henry's index is more general than the usual net rate, and is applicable to any population. When the population is stable it is converted into an ordinary net rate. On its analogy other indices were calculated to measure demo-economic reproduction, since the economic phenomenon created by any generation (or cohort of those born) is reproduced historically for a real population in unchanged quantity by the generation of their children (given invariability of the age intensities and scales of the relevant economic phenomena), if the value of the index

$$\frac{T'_{v,\,eph}}{T_{v,\,eph}} = R_0 \frac{e'_{v,\,eph}}{e^0_{v,\,eph}}$$

[1] L. Henry. In: *The Study of Population*, Chicago, 1959.

equals unity. In the given index of reproduction of economic phenomena $T'_{v,\,eph}$ and $e'_{v,\,eph}$ signify the volume of the relevant economic phenomena produced by the generation of children, and correspondingly the average magnitude of the volume of economic phenomena expected at birth to be produced by one member of the generation of children; $T_{v,\,eph}$ and $e_{v,\,eph}$ are the corresponding indices of the parent generation and R_0 is its net reproduction rate (the number of births of children per birth of parents). A value of the index of the reproduction of economic phenomena (*ceteris paribus*) in excess of unity indicates extended reproduction of the relevant economic phenomena, while a value less than unity indicates contracted reproduction.

The value of this index may be altered by the effect of the net rate (R_0). If it is altered only because of that, the trend and degree of the change will be equal to the change in value of the reproduction index of the number of survived years. In that case the volume of economic phenomena produced by the generation of children will diverge from the numbers at birth. Thus the ratio of the numbers of a population to the volume of the relevant economic phenomena will not alter and the magnitude of the phenomena per capita of the total population will also remain unaltered. In a stable population the per capita volume of phenomena would remain unaltered for the separate age groups.

The magnitude of the index of demo-economic reproduction may also be altered as a result of a change in the expectancy of the economic phenomena at birth. In that case the trend and degree of the change will not always be the trend and degree of change of the Henry index, even when the change in the expectancy of economic phenomena at birth occurs solely through a change in the average span of life (e_0^0), since the values of these two indices would be altered in the same direction only in the case when the change in the average span of life was the result of a change in mortality affecting all age groups in the same proportion.

When that condition is met the age structure of the population and the magnitude of the economic phenomena per head of the total population, and of the population of the separate age groups, for example, would remain unaltered. Since, in the course of a change in the death

rate, the ratio of the age characteristics of mortality does not vary much, the values of these two indices cannot as a rule be essentially different. Full identity of their values, however, even given this condition, can only happen when the change in the average span of life (e_0^0) is the consequence of equal changes in mortality in all age groups.

Thus the scale of the magnitudes expected at birth of the economic phenomena occurring in one year of the average span of life (e_0^0) remains unaltered (the value of one year of the average span of life expressed in units of the relevant economic phenomena).

The invariability of these magnitudes is the sole condition of the mutual interchangeability of the two indices concerned. A change in the magnitudes of economic phenomena may, however, also be the consequence of a change in their age intensities and correspondingly the scales. In that case Henry's index and the index of the reproduction of economic phenomena cannot be substituted for each other, i.e., the volume of economic phenomena produced by the generation of the children will diverge from that produced by the parent generation in a proportion different from the divergence of the total generation of the children from that of the parent generation. The ratio of the size of the population to the volumes of the relevant economic phenomena is altered, and so too is the scale of the latter per capita, for example. In that case, if the change in the age intensities and correspondingly the scales of the economic phenomena affects all age groups in equal proportion, then *ceteris paribus* only the total sum of the phenomena is altered and their age distribution remains unchanged.

The measurement and analysis of the reproduction of economic phenomena on the basis outlined above is still complicated by the fact that we have no real mortality and fertility tables of generations, or economic mortality tables, the comparison of which is extremely complex. Meanwhile the significance of such an analysis of reproduction would be invaluable as regards demographic and economic policy.

In connection with the development of economic age pyramids a need arose to restudy several questions that used to be thought more or less solved or were at least

treated in the specialised literature on economic theory and economic statistics as such, although certain doubts had been expressed in this regard. For example, can we take the quantity of products and services per head of population as an index for measuring the level of economic development? Under the influence of the work of such authors as A. G. B. Fisher, Colin Clark, Jean Fourastié, Alfred Sauvy, W. A. Lewis, H. Leibenstein, and others, the common view is that it is possible. Criticisms have been levelled in this connection, it is true. The well-known French reviewer and critic of the recent history of economic theories, Emile James, for example, wrote, in appraising Colin Clark's standpoint (who identifies economic development with rise of real income per head of population): "First, his conception of economic progress is quite open to criticism. There is progress, it would seem, every time production increases faster than population, in the sense that the real product per man and per hour worked tends to increase. But then what are we to think of the situation in which, with population diminishing, production is stagnant? What are we to think, for example, of a region where, by reason of the rural exodus, only the best lands remain cultivated? From the explanations proposed one must conclude that they have progressed, when manifestly the opposite is true. At bottom Colin Clark has never wanted to tell his readers what difference he sees between increase and economic progress, or between economic progress and technical progress, or between economic progress and social progress...."[1]

Other authors, too, have expressed certain doubts. Harvey Leibenstein, for example, lists and analyses a large number of other criteria of the level of economic development that go hand in hand with volume of production and services per head of population as the main criterion.[2]

From a comparison of economic age pyramids certain of the doubts in connection with this question seem justified to us. The production of per capita national income

[1] Émile James. *Histoire de la pensée économique au XX^e siècle*, Vol. 2, P.U.F., Paris, 1955, p. 605.

[2] H. Leibenstein. Economic Backwardness and Economic Growth. In: *Studies in the Theory of Economic Development*, John Willey and Sons, New York, 1957, pp. 38-45.

in Hungary, for example, would rise in the period between 1959-60 and 1980-81 (using the hypothesis of long-term calculations of population adopted as our basis), in 1959 prices, from 13,400 forints to 13,900 forints, i.e., by approximately 3.7 per cent even in the event of only the age structure of the population altering. The surplus of production per capita would also rise even if production, the preponderance of production, and so on, remained unaltered in the different age groups, i.e., the age structure of Hungary's population would be much more favourable from the economic angle on 1 January 1981 than it was on 1 January 1960.

This conclusion is associated with the fact that the decline in the number of births during World War I led to the number of persons aged 30 to 34 being fewer in 1948-49 than in adjacent age groups. By 1980-81 this deficit will have been in the 60-64 age group. Since the involvement of 30-year-olds in economic affairs is rather more intensive than that of 60-year-olds, the effect of the remote consequences of World War I, which were being felt in the 1940s and 1950s, would almost disappear in the 1980s.

Hungarian economists and historians have hitherto paid almost no attention in their statements to the economic significance of age structure. But it plays a very great part in the appraisal of any economic phenomenon, e.g., for understanding and explaining the economic results for any one year. Thus, in order to study the volume of national income produced in 1960 it was necessary to allow for the given age structure of the population, which was the result of natural movements and migrations occurring in the past, in particular the decline in natality during World War I. At the same time age structure is only one of the demographic factors to be taken into account. A change in the sex distribution of the population can also exert a significant influence, and so can a change in family status and other demographic criteria.

Thus there are grounds for asking whether or not one should consider the quantity of production and services per capita as an index for measuring level of economic development. If we should, then must we eliminate the effect of age structure and other demographic factors on its dynamics, and should we, correspondingly, consider that age

structure and other demographic factors affect economic development?

Can the living standard of a population be measured with the index for the volume of consumption of consumer goods and consumer services per capita?

There is a point of view that affirmative answer should be given to this question. But comparative analysis of consumption age pyramids, and the views of the adherents of this point of view raise certain doubts. In Hungary, for example, the consumption fund of the national income could rise by approximately 1 per cent between 1959-60 and 1980-81 (in 1959 prices), even if the age structure of the population altered and consumption per capita in each age group were to remain unchanged. This forces one to wonder about the truth of the customary propositions and prompts one to ask whether we should consider consumption per capita a useful indicator for measuring living standards. If the answer is yes, then should we eliminate the effect of age structure and other demographic factors on the dynamics of living standards? And should we, correspondingly, consider that age structure itself, and other demographic factors, affect living standards?

We, it should be noted, understand living standard as the standard or level of consumption. We would obtain a better idea of it in time if it were measured on the basis of the dynamics of the "average man's" consumption expected at birth. As we have found, its dynamics, of course, must be estimated in order to ensure comparability of the expected volumes of consumption (at birth), taking the unchanged prices of any one year as the base.

Can we consider the value of production per economically active person or per 1,000 working hours, and so on, an indicator for measuring labour productivity? Many researchers give an affirmative reply to that question, almost without expressing any reservations. The demographic determinateness of labour productivity has so far not been analysed in the specialist literature of economic demography. Some authors have therefore set themselves the task of studying the effect exerted by a change of labour productivity on the size of the population, and to determine how this effect is expressed. As a rule the development of production technique really increases the maximum size

of the population that "can be fed" by a certain area, but nevertheless the introduction and application of more developed technique is based in every single case on an individual evaluation, in the course of which one needs to take Sauvy's argument into account (the *cheval mangeur*, and correspondingly the *machine gourmande*[1]). It follows from these examples that the development of technique as a rule increases the nominal maximum population that a given area "can feed", but only to the extent that the volume of production over and above expenditure linked with the introduction and exploitation of new technique exceeds the previous volume of production, i.e., makes it possible to support a larger population at the former standard or at a higher one.

The conclusions drawn above, and similar ones, prompt us to give a more differentiated idea of the demographic and other effects of a change in labour productivity than is generally accepted. Therein lies their undoubted value.

But do demographic factors, e.g., the age structure of a population, influence labour productivity? In view of the fact that it changes as age increases, a change in age structure will involve a change in the amount of value of production per member of the active employed population, per 1,000 working hours, and so on. In Hungary, for example, in the period from 1959-60 to 1980-81 (using our hypotheses of the appropriate calculations of long-term population), the value of the annual product per active employed member of the population (in 1959 prices) would rise from 27,300 to 27,400 forints, and the value of the product per 1,000 working hours from 12,985 to 13,049 forints, even if these indices remained unchanged in the different age groups.

The data cited above allow us to conclude that labour productivity would rise by approximately 0.5 per cent for Hungary as a whole. The degree of this effect could diverge considerably from the figure cited within the limits of changes in the age structure before 1 January 1981 in the different regions, districts, towns, and villages, and in separate industries, factories, enterprises, and so on. In that respect, of course, the distribution of the

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[1] A. Sauvy. *Théorie générale de la population*, Vol. 1, Part XIII, Paris, 1963 (English translation: *The General Theory of Population*, 2 Vols., London, 1963).

population by other demographic criteria may also play a role. Unfortunately these problems are still unexplored country for economic demography; the dynamics of labour productivity in relation to age is the concern of very few workers.

One may legitimately ask whether the index of the value of output per active employed person, and similarly per 1,000 working hours, is a useful indicator for measuring labour productivity. If it is, one must eliminate the effect of age structure and other demographic factors on the dynamics of labour productivity. Similarly, can we consider that the age structure itself and other demographic factors affect the dynamics of labour productivity?

On this point it is necessary to answer the following questions. Has any country become economically more developed, has there been a raising of living standards and labour productivity in it, if production and consumption per capita and production per active employed person (and per 1,000 working hours) in each age group have remained unchanged or have declined, while production and hence consumption per head of the population, per head of all persons of the active population, and per 1,000 hours of the social fund of working time, have increased because of a change in structure according to other demographic criteria? Or, on the contrary, has any country become less economically developed, or has there been a lowering of living standards and labour productivity in it, if production and consumption per head of the population and production per member of the active population and correspondingly per 1,000 working hours in each age group remained unchanged or increased, while per capita production and correspondingly consumption of the population (and per active employed person and per 1,000 hours of the social fund of working time) have fallen through the effect of a change of age structure (or of structure by other demographic criteria)?

Even without such paradoxical, or seemingly paradoxical, situations, we can say that it is also necessary to determine indices from which the effect of age structure and other demographic factors has been eliminated, in addition to the traditional indices of the level of economic development, living standards (level of consumption)

and labour productivity as general indicators (indices of varying composition). One must also measure, in addition, the separate effect of age structure and of the other demographic factors.

We are far from having completed the calculations and analysis connected with economic age pyramids. We have to calculate them also for males and females, the urban and rural population, the population of various territorial units, economic areas, and for various strata of the population with a different education, i.e., we have to compute and compile economic age pyramids for the whole population of the country and for its different parts, as is done, for example, for its distribution in age pyramids by family status.

Apart from the existing economic age pyramids, we must compute other age pyramids of an economic character, for example, income age pyramids and savings age pyramids for the population.

Finally, we must also improve the long-term calculations associated with economic age pyramids. Our plans for developing the economy should also be worked out in the form of interrelated economic age pyramids comprising a single system. We would thus ensure that demographic factors over a long period were taken into account in our economic planning, and the negative consequences arising from them eliminated.

Chapter 5

METHODS OF FACTOR ANALYSIS

Doctor F. Burgchardt (GDR),
Doctor L. Osadnik (GDR)

The study of demographic processes is based on various statistical sources, in particular on censuses of population and occupational censuses. Second in importance are micro-censuses based on sampling. From micro-censuses we can obtain much valuable demographic and statistical data in a short space of time. A third source for demographic research is to draw on the secondary statistical data in the records of registrars' offices on births, deaths, and marriages, divorces, and the issue of identity cards.

In addition to these sources, it is necessary to employ special questioning, both oral and written. Questionnaires can also be useful. What is meant is a method by which experts work out special questions requiring detailed answers.

Questioning is carried out in sociological investigations, as a rule, in homogeneous economic and social groups. Important problems of such research are the social rise (social capillarity) and decline of a generation. Social shifts between groups are also studied.

A special sociological problem is "social isolation", by which we mean cases when transitions from one social group to another are rare. Another important subject of research is the social gap between spouses, for which the index of association and disassociation and Benini's index of attraction are especially important.

The theory of statistical methods in demography includes both the general theory and special theories of statisti-

cal method. The general theory is based on methods of gathering information by means of individual census papers and budget lists, and on punched-card methods of processing (*strichelung*). The special theory of statistical methods is based on individual methods, both descriptive and analytical, of studying demographic structure and processes.

The descriptive methods include techniques of obtaining and analysing averages, variations, and associations. Among the analytical methods based on full or sample censuses, techniques of factor analysis play a big role.

In considering the methods of factor analysis certain specific questions are especially important. Let us assume, for example, that factor x_i, the frequency of premature births, affects the value of y_k, the sex ratio, i.e., the number of boys born to the number of girls. To test this proposition we take frequencies for the separate values of x_i drawn from the statistics of the country concerned, and compile a table of the values of x_i and z_i corresponding to each value of y_k. Then, by mathematico-statistical methods, we calculate a corresponding table in which the effect of x_i on y_k is not considered. By comparing the two tables by means of the x^2 method we can establish experimentally exactly whether x_i influences y_k.

When it has been quite accurately established that x_i affects y_k, the question then arises whether or not the change in y_k caused by the impact of x_i has a reverse effect on x_i. To answer that we use the cybernetic theory of feedback.

It is also very interesting to know whether x_i has a very strong or a very weak effect on y_k. To answer that we ascertain the "weight" of factor x_i affecting y_k by means of regression analysis. The "weights" of a_0 and a_i in the regression equation $y_k = a_0 + \Sigma a_i x_i$ are ascertained by the least squares method, or by the Gauss-Doolittle method, or by means of an orthogonal polynomial. The indices of the "weight" of a_i designate the degree of the effect of x_i on y_k.

If many factors $x_1, x_2 \ldots$ affect the value of y_k, then the question arises whether there is any difference between their influence, which can be measured by means of variation analysis. By experimental-statistical methods we determine the values of y_k for the operative factor x_1

caused by it, for example, for the elements or individuals 1, 2. . . . In the same way we ascertain the values of y_k^2 on which factor x_2 operates, again for elements or individuals 1, 2. . . . Continuing this experimental-statistical operation we obtain the following table for operative factors x_1, x_2. . .:

$$\begin{array}{ccc} x_1 & x_2 & \dots \\ y_k^{11} & y_k^{21'} & \dots \\ y_k^{12} & y_k^{22'} & \dots \\ \cdot & \cdot & \\ \cdot & \cdot & \\ \cdot & \cdot & \end{array}$$

For this table we calculate the scatter in columns and the dispersion of mean values between columns. By comparing the results of the calculations we obtain data by means of the Fisher test on how the various factors x_1, x_2. . . affect the value of y_k.

Given the existence of many operative factors x_1, x_2. . . it is very possible that there will be a case when they are linked together so that, when one of them x_1 changes, all the others change with it.

The value of y_k on which these factors operate in that case will indicate the effect of all the factors x_1, x_2. . ., and not simply of any one factor.

The effect of each factor separately can be determined by means of partial correlation analysis, which we do in the case of the effect of n factors, excluding factor x_n at the beginning by taking it as constant. We then exclude factors x_{n-1}, x_{n-2}. . ., continuing until only that factor remains in whose effect we are interested.

In the case of the influence of two factors x_1 and x_2 on the value y_k they determine, the formula for the coefficient of partial correlation is as follows:

$$r_{x_{1/y(x_2)}} = \frac{r_{x_1y} - r_{x_1x_2} \cdot r_{x_2y}}{\sqrt{(1-r^2_{x_1x_2} \cdot (1-r^2_{x_2y})}} .$$

In the case of a large number of operative factors x_1, x_2. . . the question arises which of them represents the whole aggregate. That can be answered by means of Konfluenz analysis. We start with a system of the linear equations of regression analysis, with partial regression factors. These factors are ascertained and plotted on a

graph, the denominator being laid out along the X-axis and the numerator along the Y-axis. The graph is made for two variables to begin with, and two rays are obtained. By adding other variables we obtain the rest of the rays. If the beam of rays is closed when a new variable is added, that variable is useful or usable. If, however, the beam opens out that variable is harmful. Between the two types there is another, of superfluous or unnecessary variables.

Many factors x_1, x_2. . . operate on various values y_k, y_e. . . in various demographic situations. It therefore remains to compute the main causal factors exerting the influence. These causal factors are differentiated by means of a special analytical technique. We resolve it by factor analysis.

Various mathematical methods are employed in demography. We have in mind primarily the mathematical methods by which statistical problems are studied, which include, for example, the methods of synthesis, deduction, and induction, and the least squares method. There are also methods by which dynamic problems are investigated, namely differential and integral equations. By means of differential equations we can determine the parameters of demographic processes, and by means of integral equations the process of the renewal of demographic aggregates.

Demographic workers employ various hypotheses. Here we would mention, for example, Ploss' hypothesis of nutrition, and the hypothesis of the varying effect of external living conditions on members of the male and female sexes. In addition we should mention the hypotheses by which demographic problems were studied by mathematicians in the seventeenth and eighteenth centuries.

The success of demographic research is due to a considerable extent to the use of mathematical models. Among them we must note those of a stationary, stable, and logistic population. Furthermore, we must mention the model of reproduction, namely the crude and net reproduction rates. The cohort model also plays an important part in demographic research.

In the statistical investigation of cohorts the question arises whether the development of each of the different elements of the cohort conforms with that of the others,

or whether it differs. Cohorts in which the development of the different elements coincides are called homogeneous. Otherwise we would deal with heterogeneous cohorts. Homogeneous cohorts are investigated by means of longitudinal analysis. Analysis presupposes consideration of the elements of a cohort of one and the same year of birth over a certain period of time.

We must also mention the model for determining optimum population, by which we mean the size of the population most desirable in a certain region. For that we have to define precisely in what way this desirability is being considered. If it is a case of the economic optimum of a population, then we have in mind the size of a population which will ensure the inhabitants of a certain region the maximum material prosperity.

An important role is played in demographic research by the forecasting of demographic processes. This calls for calculations that are based on data on the already existing population and on the assumed future development of fertility, mortality, and migration. In forecasting we have to take into account that the time interval for which the forecast is being made must not be too long.

Chapter 6

PROBLEMS OF DEMOGRAPHIC FORECASTING

B. T. Urlanis, D. Sc. (Econ.)

Social life has its own laws, knowledge of which makes it possible to draw definite conclusions about the future. But we must allow for there being broad scope for man's intervention in one sphere or another of social relations, and for that intervention being easily able to upset any forecast. It then remains unknown whether the forecast was wrong or whether certain circumstances prevented the predicted events from happening.

This difficulty in predicting the development of social life does not in the least mean that forecasting is impossible in the social sciences. Much can be predicted in social life, if it is based on the laws of social development. Brilliant evidence of that is the work of Karl Marx, Frederick Engels, and V. I. Lenin. Marx, having established the laws of development of the capitalist mode of production, predicted the main trends, the main paths, along which capitalism was developing, with the insight of genius. He forecast the growth of the revolutionary movement and the inevitability of the replacement of capitalism by socialism and communism.

Lenin, who creatively continued and developed the ideas of Marx and Engels, predicted the inevitability of the revolution precisely in Russia. These examples, and others, show that forecasting is possible in the social sciences.

Forecasts may be expressed in a qualitative characteristic of processes that must inevitably occur, as well as in a quantitative characteristic. They are based on study of the factors determining such and such phenomena.

In the economic sciences forecasting has found wide application. It is also used in the field of population studies. In demography the point of departure for a scientific forecast is full, exact knowledge of the present. One must have information on the size and composition of a population at the time of the forecast, and on the groupings of the population by various socio-economic criteria, and must have data characterising the intensity of the principal demographic indices, i.e., natality, mortality, and migration. The combination of these data for the groups of the population as constituted at a definite time makes it possible to draw certain conclusions, which may relate to the separate groups of the population as well as to its total. Demographic forecasts give an idea of the long-term distribution of population by age and sex, as urban and rural, or by areas within a country.

A forecast of future population is built up from data on its existing age structure, and on the processes determining its future numbers. It is possible, of course, to underestimate or exaggerate the effect of one factor or another on the dynamics of a population, but what is today must nevertheless exert a big influence on its size, at least in the very near future.

The length of the time interval for which a forecast is being made has a big influence on its reliability. From that angle all forecasts can be divided into the following types:

1. short-term forecasts made for approximately five years ahead; they have a high degree of reliability and are most important for compiling five-year plans of economic development;
2. medium-term forecasts, for fifteen to twenty years ahead; their reliability is lower than that of short-term ones, but they reflect the general trend of the dynamics of the population already laid down in the present (from the standpoint of the economy such forecasts provide the basis for long-term forward planning);
3. long-term forecasts for thirty to fifty years ahead; their interest lies mainly in their indicating the population

at a fairly distant time provided that the processes operating at present continue to do so.

The type of forecast determines the method to be used. A method that is quite suitable for a short-term forecast will be unsuitable for a medium-term one, and vice versa.

As regards the size of a population, so-called conditional forecasts are widely used. Most of those made are based on certain premises; they have value insofar as their premises have been successfully indicated. Their authors do not say "the population of country *A* will be *K* million in such and such a year", but they say: "The population of a country *A* will be *K* million in such and such a year, provided that mortality and natality remain at a certain level." Thus the test of the correctness of a forecast is essentially a matter of testing the correctness of the hypotheses advanced.

Most authors of estimates do not omit to mention that their forecast of the population is a provisional one. Furthermore, the conditionality of the forecast is stressed by the fact that more than one variant are suggested; as a result a "fork" develops, graphically indicating the divergence between the different variants of the forecast.

Some authors suggest that it is more appropriate in general to speak of tentative calculations of a population rather than of a forecast of its size. This view was held, for example, by the well-known demographer Robert Kuczynski. "We should clearly distinguish," he wrote, "between estimates meant to be forecasts, and computations which merely show what will be the trend of population on certain definite assumptions. To predict the actual population of Europe ten years from now would involve a risk which no serious statistician should be willing to shoulder; he need only remember that quite unexpectedly the population of Europe between 1914 and 1919 decreased by 12 million."[1] The example from World War I, however, is not convincing, since everyone realises that all forecasts are disrupted by war. Forecasts are only adapted to peacetime, and with a proper exact method can give quite good results.

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[1] Robert R. Kuczynski. *Population Movements*, Oxford, 1936, pp. 49-50.

Any forecast, understandably, however finely it has been constructed, may not coincide with reality. The question arises whether it is possible to foresee this error, and whether its degree of probability can be calculated. It is extremely tempting to use the apparatus of the theory of probability here, and to introduce much greater clarity into the problem of a forecast's reliability. Many workers adopt this approach as quite natural, and even speak of the "probable error" of a forecast. We suggest, however, that there is no basis for employing the theory of probability in this field.

By making a selective study, having obtained summary criteria characterising the sampled aggregate, we may extend the data obtained to the whole general aggregate. This operation, too, is a kind of forecast. We predict, as it were, the results of a complex investigation and determine them in advance. Sampling technique is of great theoretical value in this; but here too we are very far from being able to interpret the occurrence of all future events in the spirit of the theory of probability. The intensity of demographic processes does not fit in, in the least, with the schemes of the theory of probability.

Does it follow from that that it is impossible to determine the margin of error of forecasts? Not at all. The possible error of a forecast is indicated by the difference between two opposed variants. Since both variants started from diametrically opposite premises, reality cannot lie outside these limits. That must not be understood, of course, in too categorical a way. In statements that reality will not lie outside certain limits there is a certain degree of probability; but it is impossible to determine it since the schemes of the theory of probability are not applicable to them.

In speaking about the forecasting of demographic phenomena, it is not without interest to note that certain scientists in other countries have attempted in their time to turn demographic science away in this respect from social problems to the field of biological, climatological, even cosmic problems. Let us recall, for example, B. G. Jenkins, who assured readers of the *Journal of the Royal Statistical Society* in 1879 that he had discovered a means of forecasting the death rate in Great Britain. Jenkins considered that there was a probable connection

between the yearly death rates and the position of the planet Jupiter in its orbit. Unfortunately he was not alone. A number of other demographers have tried to link cosmic factors with the dynamics of future population.[1]

It is necessary, further, to touch on a problem of a terminological character. What are we to call the calculations of future population as applied to the USSR? What are they, long-term computations, forecasts, estimates, or rough drafts?

The planning of production calls for corresponding planning of the labour force; but the sphere of planning ends there. With the transition from labour force to population we move from planning to forecasting.

Estimates of the future population are thus necessary, and without them it is impossible to plan the economy; but all these estimates must be made as forecasts of its size. We say forecasts because it is a matter in this case of predicting the behaviour of people in such and such a socio-economic situation, on the one hand (age of marrying, number of children per marriage, etc.), and, on the other hand, of predicting future living standards, the effectiveness of health care, and science's advances in prolonging human life. Allowing for all these factors in estimates of the future number of births and deaths can lead to indices of the future population lacking any high degree of probability, and diverging from reality.

The point is that, in order to get the closest possible coincidence with reality, it is necessary to use the most accurate methods of forecasting.

The ordinary methods of forecasting total population amount to using contemporary age-specific death and fertility rates. Given the age and sex structure of the population it is not difficult, employing the death rate determined for each age group, to compute the total expected number of deaths in a future year. If we have the age structure of the contingent bearing children, it is not difficult, by applying a certain fertility factor to each group, to obtain the expected number of births in the future. But the application of these methods is essentially a purely arithmetic solution of the problem.

[1] G. H. Knibbs. *The Shadow of the World's Future*, London, 1928.

The quality of the forecast is not high; and it is not surprising when the actual figures are found to diverge from it. The whole art of demography consists in determining the population on the basis of studying the possible changes in existing rates rather than on extending them to the future.

As regards natality, it is necessary, for example, to analyse the dynamics of the yearly fertility factors of the Union republics of the USSR in the recent past thoroughly, and on that basis to outline its future dynamics. Use of the cohort method can prove very helpful in that as it enables us to study the fertility of a certain generation of females, i.e., of women of the same year of birth. Their fertility curve helps us to bring out the pattern of behaviour of women in forming a family over the whole of their married life. Usually the fertility factor rises with time to a certain age (around 23 to 25), when a maximum is observed, and then declines, falling to zero at around fifty.

For most cohorts of females the maximum fertility factor can be ascertained now, in the present; and that makes it possible to determine their future fertility factor quite accurately since, in this case, extrapolation after maximum fertility has been reached has a greater chance of coinciding with reality than simple extrapolation of age-specific fertility factors.

As to mortality, demographers must also analyse the dynamics of the age rates for each sex separately; and in extrapolating the dynamics of these rates to the future they must start from those already achieved by the most advanced areas of the country at the present time, or by the countries most advanced in this respect. The future level of age-specific mortality can be predicted much more accurately when it is done by using forecasts of the possible decline in deaths from separate causes.

So that forecasting of the number of births and deaths can be more successful, we must consider using regression equations. Thus, for example, having the regression equation between fertility and the provision of children's institutions, we can envisage its effect on the birth rate when planning a certain increase in this provision.

Birth and death rates affect the accuracy of population forecasts. The higher they are, the lower is the accuracy of the forecast, and vice versa. A population forecast with

high natality may therefore diverge widely from reality; if natality falls more than is allowed for in the forecast, the population will prove to be much smaller than was suggested.

Things are rather different as regards the quality of a forecast when natality and mortality are both already low. Then the probability of major surprises in future birth and death rates is lower, and the accuracy of the forecast in these conditions is much higher. Of course, in a country with low natality mortality may rise, but change in the number of those born cannot in any case be so significant as to diverge in a marked way from the long-term computations.

In forecasting population it is necessary to allow both for significant exaggeration and for real underestimation of its size complicating the carrying out of long-term economic development plans. In order to forecast population, therefore, it is necessary to have the results of fundamental selective studies at one's disposal, and also the returns of censuses covering questions regarding fertility. Without that no forecast can be sufficiently accurate.

Section Four

WORLD POPULATION AND RESOURCES

One of the problems most widely discussed by scientists, publicists, and politicians is that of supplying the world's growing population with the planet's natural resources.

The Malthusian claim that the limited nature of the world's resources is coming into contradiction with the biological tendency of people to continuous growth of numbers has not lacked supporters up to the present among bourgeois population theorists. Malthus' modern followers see birth control as the main means of realising his ideas in practice.

Apart from the outspoken Neo-Malthusians, who consider exhaustion of the Earth's resources to be already a very real danger at the present time as a result of the rapid growth of population (Harrison Brown, Frederick Osborn, William Vogt, and others), one finds a considerable number of bourgeois scientists—sociologists, economists, and geographers—who adopt a more optimistic position (Dudley Stamp, J. L. Fisher, E. A. Ackerman, and others). But they all consider the supply of natural resources for growing humanity quite an acute problem.

While rejecting the Malthusian doctrine as anti-historical, as not adequately allowing for the role of the productive forces, and as completely ignoring the decisive role of the social system, Marxists recognise the importance of all-round study of the present-day and long-term supply of the most important natural resources for the population.

Alluding to the prospects for mankind's development during his visit to the USA in 1973, L. I. Brezhnev noted that continuous progress was engendering vast growth of people's needs and requirements. Demand for raw materials of various kinds is rising; and although more and more new deposits are being brought into commercial exploitation every year, the reserves of many natural resources are not in the long run unlimited. The problem of their rational use is therefore very real, because their irrational use could not only damage the environment but also affect the state of people's health.

Given the joint existence in the world of the community of socialist countries, and of imperialist and developing countries, of sharp contradictions between socialism and imperialism, and of the national liberation struggle of many peoples for political and economic independence, estimates of the provision of resources for the population are inevitably provisional and arbitrary. Nevertheless, bearing in mind the outlook for growth of world population, and the scale of the scientific discussions and sharpness of the ideological struggle between representatives of Marxist-Leninist methodology and bourgeois scientists in the field of population theory and practice, it is advisable briefly to review the position as regards supply of the most important types of natural resource.

The steadily increasing industrial development of most countries is also making it desirable to appraise the raw material possibilities for the development of industry, above all of power engineering as the core of all branches of the modern economy, as well as the traditionally more often discussed food situation.

Chapter 1

WORLD POPULATION GROWTH

B. T. Urlanis, D. Sc. (Econ.)

Man separated off from the animal kingdom approximately a million years ago. The research of archaeologists and palaeodemographers makes it possible to retrace an approximate picture of the dynamics of population in remote times. For hundreds of thousands of years during the Palaeolithic mankind multiplied extremely slowly.

Taking the land area over which man led a hunting and food-gathering existence as 40 million square kilometres, and taking the average density of population under that mode of production as 0.08 persons per square kilometre, we may tentatively assume that the number of men on Earth at the end of the Palaeolithic had reached about three million. During the Mesolithic the rate of population increase rose compared with the Palaeolithic and reached about 15 per cent per millennium (according to our tentative calculations), while the human population rose from three to ten million.

The length of the Neolithic period can be taken as around 5,000 years. It was marked by a kind of technical revolution caused by the social division of labour, which led to marked raising of the rate of increase of population. Approximate estimates indicate that mankind increased in numbers during the Neolithic from ten to fifty million, i.e., fivefold in 5,000 years (or around 40 per cent per millennium).

The world's population at the beginning of our era, as estimated by the Soviet demographer F. D. Markuzon,[1] can be represented as shown in Table 14.

Table 14

World Population at the Beginning of Our Era (after Markuzon)

Part of the World	Population (in millions)
Europe	35
Asia	220
North and Central America	21
South America	19
Africa	30
Oceania	1.5
Total:	326.5

The data for Asia and America, in our opinion, however, are exaggerated. Markuzon took the population of India at the beginning of our era as a hundred million. Yet he himself pointed out that such an estimate gave a density of 20 to 25 persons per square kilometre, which, he wrote, "is unusually high for that time". The American scientist, M. K. Bennett, Director of the Food Research Institute of Stanford University, even took the population of India in A.D. 1000 as 48 million. We consider it more correct to take India's population at the beginning of our era of between 30 and 40 million. As to China, there are direct data on the population at that time which can be used as the basis for estimates.

The population of the Americas, at 40 million, is also exaggerated. The level of farming technique at that time could not ensure production of enough food for such a huge number of people. According to the estimate of the American anthropologist J. Q. Stewart, the population of all the Americas at the end of the fifteenth century was around 15,500,000[2]; at the beginning of our era it

[1] See F. D. Markuzon. World Population from the Beginning of Our Era to the Beginning of the Twentieth Century. In: *Voprosy ekonomiki, planirovaniya i statistiki* (Problems of Economics, Planning and Statistics), Moscow, 1957, p. 404.

[2] See *Naseleniye mira* (World Population), Moscow, 1965, p. 39.

possibly did not exceed ten million. Correcting the population of India and the Americas for exaggeration, we obtain a figure of around 230 million for the number of people living on Earth at the beginning of our era. Many areas of the world were quite unpopulated at that time, or very thinly occupied; about two-thirds of the planet's inhabitants lived in Asia.

During the first millennium of our era population growth continued, but probably at a rather slower rate than earlier. Progress in agricultural technique was very slow, and at the same time wars and epidemics carried off a vast number of people in Europe, Asia, and North Africa.

The approximate population of the world in A.D. 1000 was put by Bennett at 275,000,000. If we take that figure we may assume that population grew by only 20 per cent in that millennium. For the next five centuries Bennett gave the figures for the world's population shown in Table 15.[1]

Table 15

World Population (after M. K. Bennett)

(in millions)

Year	Europe	Asia (in Russia)	South-West Asia	India	China	Japan	South-East Asia and Oceania	Africa	America	The World
1000	42	5	32	48	70	4	11	50	13	275
1100	48	6	33	50	79	6	12	55	17	306
1200	61	7	34	51	89	8	14	61	23	348
1300	73	8	33	50	99	11	15	67	28	384
1400	45	9	27	46	112	14	16	74	30	373
1500	69	11	29	54	125	16	19	82	41	446

Bennett's estimates raised serious doubts in many respects. Thus, for example, his figure for Europe in 1400 is quite unreal. As the reason for the decline in Europe's population he adduced the epidemic of the Black Death, but did not allow for the growth of population in the fifty years after it, which brought numbers back to those at the beginning of the century. In addition, the sugges-

[1] Cited by Robert C. Cook (Ed.) in: How Many People Have Ever Lived on Earth?, *Population Bulletin*, 1962, 1:10, 12.

tion of a rapid growth of population in the Americas between A.D. 1000 and 1500 from 13 million to 41 million is quite unsubstantiated.

As to Japan the figures do not differ much from the estimates made by specialists in that country's history. Thus, according to Ryoichi Ishii's data, the dynamics of Japan's population was as expressed by the figures in Table 16.[1]

Table 16

Dynamics of Japan's Population, 9th to 16th Centuries (after Ishii)

Period	Population (in millions)
Beginning of the ninth century	3.7
Middle of the eleventh century	4.4
End of the sixteenth century	18.0

According to Bennett, Japan's population quadrupled over 500 years; according to Ishii, it increased nearly fivefold in 600 years.

As to China there are grounds for thinking that Bennett gave figures exceeding the actual ones. Therefore we may consider that whereas he underestimated the population of Europe, he exaggerated that of both the Americas and Asia by approximately the same amount.

We may take the world's population for 1500 A.D. as 450 million, which gives a 64-per cent increase in the first 500 years of the second millennium A.D.

To estimate the population in subsequent centuries we may take the estimates of the British demographer A. M. Carr-Saunders and the American W. F. Willcox, based on circumstantial theoretical analysis. Willcox's estimates for 1650-1900, published in 1931, are given in Table 17.[2]

[1] R. Ishii. *Population Pressure and Economic Life in Japan*, London, 1937, p. 3.

[2] Walter F. Willcox. Increase in the Population of the Earth and of the Continents since 1650. In: *International Migrations*, National Bureau of Economic Research. Vol. II, New York, 1931, pp. 33-82.

Table 17

**Dynamics of World Population (1650-1900)
(after Willcox) (in millions)**

Year	Europe *	Asia **	North America	Latin America	Africa	Oceania	Total
1650	103	257	1	7	100	2	470
1750	144	437	1	10	100	2	694
1800	193	595	6	23	100	2	919
1850	274	656	26	33	100	2	1,091
1900	423	857	81	63	141	6	1,571

* Including Asiatic Russia.
** Excluding Asiatic Russia.

Five years after his estimates, a similar series on the dynamics of world population for the same period of 250 years was published by Carr-Saunders (see Table 18).[1]

Table 18

World Population (after Carr-Saunders)
(in millions)

Year	Europe *	Asia **	North America	Latin America	Africa	Oceania	Total
1650	103	327	1	12	100	2	545
1750	144	475	1	11	95	2	728
1800	192	597	6	19	90	2	906
1850	274	741	26	33	95	2	1,171
1900	423	915	81	63	120	6	1,608

* Including Asiatic Russia.
** Excluding Asiatic Russia.

His estimates differed little from Willcox's, with the exception of the figures for Asia. Carr-Saunders considered the population of Asia in 1650 to be 70 million larger than Willcox's estimate. His correction seems appropriate and we shall adopt it as the basis for our estimate.

Thus, if we take Carr-Saunders' figures, the planet's population rose from 450 million to 550 million between

[1] A. M. Carr-Saunders. *World Population. Past Growth and Present Trends*, Oxford, 1936, pp. 30, 42.

1500 and 1650, or by 22 per cent over 150 years, which gives an annual rate of increase of 0.13 per cent.

For the next two centuries, i.e., from 1650 to 1850, the two authors' figures differed somewhat from one another, the divergence being due to the fact that Carr-Saunders thought the growth of population in Asia was much more considerable than Willcox estimated it.

During the second half of the nineteenth century the rate of increase accelerated considerably. Epidemics, famine, and wars, it is true, still inflicted heavy loss of people, but for all that it was less than before; the progress of medicine, transport, and agriculture had led to the beginning of a decline in mortality, which gave rise, with a stable birth rate, to an increase of natural growth.

The dynamics of world population in the twentieth century is reflected in the figures in Table 19 as of the middle of the year indicated.[1]

Table 19

Current Dynamics of World Population
(in millions)

Year	USSR	Europe *	Asia *	Africa	America	Australia and Oceania	Total
1900	132	300	915	120	144	6	1,617
1910	154	344	940	130	180	7	1,755
1920	158	329	966	141	208	9	1,811
1930	179	355	1,120	164	242	10	2,070
1940	195	380	1,244	191	274	11	2,295
1950	180	392	1,356	217	328	13	2,486
1960	214	425	1,645	270	412	16	2,982
1970	243	462	2,053	344	511	19	3,632

* Excluding the USSR.

World population reached 1,000 million about 1820, 2,000 million 109 years later in 1929, and 3,000 million 31 years later in 1960. According to United Nations estimates world population reached 4,000 million in 1976, i.e., 16 years later. That is it has doubled since 1929 (taking 47 years).

[1] See *Demographic Yearbook*, New York, 1970, p. 105; *Naseleniye mira*, p. 8.

At the beginning of the twentieth century the total population of the planet slightly exceeded 1,600 million, and had doubled by 1964. Thus 64 years were needed to double the population. At present rates of increase, doubling will require only 35 years.

The comparative dynamics of population growth in various parts of the world in the twentieth century is shown in Table 20.

Table 20

World Population Growth in the Twentieth Century

(1900 = 100)

Year	USSR	Europe *	Asia *	Africa	America	Australia and Oceania	Total
1900	100	100	100	100	100	100	100
1910	117	115	103	108	125	117	108
1920	120	110	106	117	144	150	112
1930	136	118	122	137	168	167	128
1940	148	127	136	159	190	183	142
1950	136	131	148	181	228	217	154
1960	162	142	180	225	286	267	184
1970	184	154	224	287	352	317	225

* Excluding the USSR.

For the first two-thirds of the century an increase of population has been observed in all parts of the world. The highest increase has taken place in the Americas where the population has grown 3.5 times in this period.

The population of Africa has nearly trebled, and that of Asia more than doubled. The population of the USSR has grown by 83 per cent, and of the rest of Europe by 50 per cent.

The mean annual rate of population increase has altered as shown in Table 21.

With a general trend to higher rates of increase, the effect of the world wars is very marked in separate decades. During the second decade the consequences of World War I reduced the rate of increase. As to World War II, its effect was felt only in the USSR and the rest of Europe. For the decade 1940-50 world population as a whole increased by approximately 1 per cent per annum.

Table 21

Mean Annual Rate of Increase of World Population
(in percentages)

Period	USSR	Europe *	Asia *	Africa	America	Australia and Oceania	Total
1900-10	1.55	1.38	0.31	0.81	2.26	1.55	0.99
1910-20	0.25	—0.43	0.27	0.82	1.46	2.50	0.31
1920-30	1.26	0.76	1.49	1.52	1.53	1.06	1.35
1930-40	0.86	0.63	1.09	1.54	1.25	0.96	0.81
1940-50	—0.99	0.31	0.87	1.29	1.79	1.69	0.80
1950-60	1.74	0.81	2.05	2.21	2.33	2.09	1.84
1960-70	1.28	0.84	2.24	2.45	2.18	1.73	1.99

* Excluding the USSR.

A steep rise in the rate of increase occurred in the sixth decade, mainly as a result of the lowering of infant mortality. The rate of increase doubled and reached almost 2 per cent per annum. About the same rate was observed in the seventh decade.

All the foregoing data on rates of increase are summarised in Table 22.

Population growth is clearly accelerating. But we cannot affirm that this acceleration has been uninterrupted or continuous. It can be seen from the table that the rate in the first millennium A.D. was considerably below that of antiquity before our era. This is possibly explained by the collapse of the slave system in Europe, the great transmigration of nations, bloody wars in Asia, and devastating epidemics such as had not occurred earlier.

During the last 2,000 years the rate of increase has been systematically accelerating. The annual rate of increase is now dozens of times what it was in the first millennium A.D.

It is important, however, to note that at present, with a mean rate of increase of about 2 per cent, there are marked differences between different countries.

This comes out very clearly in the table we have compiled for 130 countries with a population of 500,000 and more (which also include the effect of migration). In only eleven countries did we have to take the rate of increase without allowing for migration (Angola, Lesotho, Libya, Mozambique, Sierra Leone, Tunisia, Uganda, Costa

Table 22

Chronology	Period	Length of period (years)	Population at beginning of period (millions)	Population growth during period (in percentages)	
				per millennium	per annum
Years B.C. one million			0.01-0.02		
	Early Palaeolithic	around 900,000		fraction of 1	—
100,000			0.2-0.3		
	Middle Palaeolithic	70,000		3	—
30,000			1		
	Late Palaeolithic	15,000		8	—
15,000			3		
	Mesolithic	8,000		15	—
7000			10		
	Neolithic	5,000		40	0.03
2000			50		
	Age of metals. Classical antiquity	2,000		—	0.1
Years A.D.			230		
	End of classical antiquity. Early Middle Ages	1,000		—	0.02
1000			275		
	Middle Ages	500		—	0.1
1500			450		
	Late Middle Ages. Beginning of modern times	300		—	0.2
1800			919		
	Modern times	100		—	0.6
1900			1,617		
	Beginning of twentieth century	50		—	1.0
1950			2,486		
	The present	24		—	1.93
1974			3,933		

Rica, Trinidad and Tobago, Cambodia, and Nepal. All the data refer to the period 1963-70, and for the enumerated countries to 1965-70 (except for Trinidad and Tobago for which 1969 was taken). The distribution of all these 130 countries by rates of increase and areas of the world is shown in Table 23.

Table 23

Rates of Increase of World Population (1963-70)
(130 countries with a population of 500,000 and more)

Rate of Increase (percentage)	Africa	America	Asia *	Europe **	Australia and Oceania	Total
0.0	—	—	—	1	—	1
0.0-0.9	1	—	—	16	—	17
1.0-1.9	4	6	5	8	1	24
2.0-2.9	28	6	21	—	2	57
3.0-3.9	8	14	7	1	1	31
Total:	41	26	33	26	4	130

* Excluding the Asiatic part of the USSR.
** Including the Asiatic part of the USSR.

The parts of the world differ in the character of the distribution of countries by rates of increase. In Europe countries with a rate not exceeding 1 per cent predominate. The sole exception is Albania, in which the rate of increase exceeds 3 per cent. In Africa and Asia countries with a rate exceeding 2 per cent but under 3 per cent predominate. Finally, in the Americas countries that have a rate of increase of 3 per cent or more predominate. These countries include the states of Latin America, which is the zone that is, as it were, the epicentre of the "population explosion". In them (except Argentina and Uruguay) deliberate limitation of the number of children in the family is almost not practised, and natality remains high, while, at the same time, infant mortality has been significantly reduced.

A decline of population is observed only in West Berlin, where it is diminishing annually by 0.3 per cent. The maximum rate of increase is in several states of Latin

America (El Salvador and Costa Rica 3.8 per cent; Nicaragua 3.7 per cent; Venezuela 3.6 per cent), and in Asia (Jordan 3.7 per cent).

What will the rate of increase be in the immediate future? Will the process of continuously accelerating world population growth go on in the future, or has it reached its peak?

According to UN estimates it will drop by the end of the century to 1.7 per cent per annum. There are grounds for thinking that the next decades will be those of maximum population growth in the history of mankind. After them humanity will enter a period of gradual slackening off of rates of increase, and we may suppose that its numbers will become stabilised in the more distant future, which will happen (there are grounds for assuming) in the second half of the twenty-first century, when world population will reach 11,000 to 12,000 million.

Chapter 2

POPULATION AND ENVIRONMENT

Y. G. Saushkin, D. Sc. (Geog.)

As social production develops man acquires greater and greater opportunities of modifying his geographical environment in his own interests. Change of the environment is a continuous process, since rapidly developing industry and the new demands of social life lead to new human action upon it. "...The world does not satisfy man," Lenin wrote, "and man decides to change it by his activity."[1]

The effect of social production on the geographical environment and the reverse effect of this environment (and all the changes in it) on various aspects of man's life and work are historically inconstant. The character of the interaction of the geographical environment and human life is governed by the whole mode of social production, i.e., by the special features of social development and scientific and technical progress. Under capitalism this interaction differs greatly from its processes and results under socialism.

Several aspects of the effect of this interaction on people's lives must be distinguished. One of them is that the environment strongly affects settlement and the character of populated points, both rural and urban. A certain mutual dependence is established between settlement and the environment, which is refracted through features of the

[1] V. I. Lenin. Conspectus of Hegel's book "The Science of Logic", *Collected Works*, Vol. 38, p. 213.

social system and the level of development of the productive forces.

Another aspect of the interaction is the effect of the geographical environment on man's physiological life and ecology. Human life depends on atmospheric pressure and the state of the atmosphere, on the quality of drinking water, the character of food, temperature conditions, and interaction with other organisms of the environment. Human ecology is associated, in particular, with radioactive, chemical, and other pollution of the environment.

Man adapts himself to external natural conditions not so much biologically as socially, through the medium of material production. In migrating from certain natural conditions to others he not only relies on already developed adaptive mechanisms but also, as a rule, on encountering new conditions, creates living conditions for himself appropriate to his needs, i.e., he actively adapts himself to the new conditions. High-altitude conditions of life are the most difficult to alter. Mountain folk do not quickly adapt to life on plains. But on the whole we find the same kind of reproduction and pathology in various geographical conditions, and on the contrary different types in the same geographical conditions, depending on socio-economic conditions.

Climatic, physico-chemical, and other features of the environment affect morbidity, mortality, and other demographic processes indirectly, being refracted through a whole complex of socio-economic conditions, through people's social life, and above all through their position (status) in society, and also through their consciousness and behaviour. Even man's defensive, adaptive mechanisms are a unity of the social and the biological. While by nature a biological phenomenon, they at the same time bear the impress of the effect of socio-economic factors.

A third aspect of the interaction is that the geographical environment (given equality of social conditions and level of science and technique in a number of branches of the economy) essentially affects the conditions of work and its seasonality, especially in agriculture, fishing, the open-cast mining of minerals, etc. Long years, in some cases centuries, of the effect of the environment on man's labour have left their mark on people's working habits. Other conditions being equal, productivity of labour de-

pends on the character of the environment's effect on work.

The geographical environment acquires new properties from year to year and century to century, which develop as a result of the action of human labour. For thousands of years of historical time man has been making the environment much better to live and work in.

A fourth aspect is that the geographical environment affects the moulding of human ethnic formations, or the *ethnos*.

The moulding of the environment is a complicated and contradictory historical process. All new elements of the environment itself are particles of nature like its natural ones (rivers, cliffs, lakes, seas, steppes, etc.). At the same time the most important changes in the environment caused by human activity are synchronous with the main periods of society's history, and are engendered by its tasks and determined by the character of social production.

The present-day environment differs greatly from "virgin" (prehistoric) nature in the acceleration and great dynamism of natural processes, as a result of which disparities and contradictions take shape, which are often spoken of in the literature as "disturbances of the balance of nature". The environment is an integral, complex, dynamic, continuously developing system. In such a system there cannot be a "balance" or "equilibrium" in the full sense of the term because that would mean the stopping of its development. It is something else, a host of direct and feedback connections between various asynchronous natural processes and phenomena, some of which began in deep antiquity and others comparatively recently. These direct and feedback links are disturbed and broken during the moulding of a qualitatively new environment in place of "virgin" nature, and new connections develop. The disturbance of age-old links entails a long series of unforeseen consequences, which also begin to affect people's life and work in an essential, and even negative way. We may speak of the "chain reactions" that human activity sparks off in the environment. The unforeseen negative "chain reactions" for which capitalist industry paved the way have attained an enormous scale in recent decades and are evoking great concern.

At present, in a number of the biggest industrialised capitalist countries, pollution of the environment by industrial wastes has reached such proportions as to seriously threaten all humanity, and has given rise to the danger of an "ecological crisis". By "ecological crisis" modern science means such an extreme degree of disturbance of nature and pollution of the environment, reduction of oxygen and increase of carbon dioxide in the atmosphere, and shrinkage of reserves of fresh water, that humanity could no longer survive in it. The concept has arisen above all from the enormous scale of industrial pollution in the United States (on whose territory up to half the world volume of pollution has occurred), in Japan, the Federal Republic of Germany, Italy, and certain other countries. Pollution of the world ocean by petroleum and oil products is a great danger because even a thin film of oil causes the death of marine organisms and disturbs gas exchange between the ocean (the main source of oxygen) and the atmosphere.

The development of large-scale capitalist industry has led to very heavy industrial removal of chemical elements from the interior of the earth to the atmosphere, hydrosphere, and biosphere. The percentage content of carbon dioxide, sulphur dioxide, and other compounds in the atmosphere is rising. The effluent of industrial enterprises, and the waters flowing from fields to which mineral fertilisers and pesticides have been extensively applied, are polluting many rivers and lakes. The dispersion of iron and other chemical elements in the biosphere is affecting the processes of soil formation and the development of organic life. Especially dangerous to human health is raising of the radioactivity of the environment caused through the explosion of atomic and hydrogen bombs and the irresponsible attitude of capitalist entrepreneurs to the wastes of atomic power stations and certain facilities of the atomic industry.

Atomic war could inflict enormous losses on mankind. As L. I. Brezhnev has said in this connection, our planet "is quite big enough for us to live in peace on it, but too small for it to be exposed to the threat of nuclear war".[1]

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[1] *Pravda*, 23 June 1973.

Much attention was paid to the defence of nature in the USSR in the Report of the Central Committee to the 24th Congress of the CPSU: "As we take steps to speed up scientific and technical progress, we must see to it that it should combine with the rational treatment of natural resources and should not cause dangerous air and water pollution or exhaust the soil. The Party demands most emphatically that the planning and economic bodies and design organisations, all our cadres, should keep the question of nature protection within their field of vision when designing and building new enterprises or improving the work of existing ones. Not we alone, but the coming generations should also be able to use and enjoy all the gifts of our country's splendid natural environment."[1]

In September 1972 the Supreme Soviet of the USSR passed a decree on measures for further improvement of nature conservancy and rational use of natural resources, in which it was said that successful implementation of national economic plans and the well-being of the present and future generations depended on them. "In socialist society solution of this problem is indissolubly linked with protection of the people's health and with providing the requisite conditions for fruitful work and leisure for the Soviet people."[2] In particular, the Supreme Soviet laid it down that the USSR's programme of economic development "must be based on far-reaching all-round research, and accompanied with scientific forecasts of the possible consequences and an obligatory system of measures to ensure that there is no harmful effect on the natural environment. It is our duty to preserve and multiply all the wealth and beauty of nature for the generations that will live in communist society."[3]

In July 1975 the Supreme Soviet adopted a decree on measures for further improvement of the protection of mineral wealth and use of natural resources and passed a law confirming the fundamentals of legislation of the USSR and Union republics on mineral resources, laying down that the ensuring of rational, complex, and economical utilisation of mineral resources and their im-

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[1] *24th Congress of the CPSU*, Novosti Press Agency Publishing House, Moscow, 1971, pp. 69-70.

[2] *Pravda*, 21 September 1972.

[3] *Ibid.*

proved conservation in the interests of further development of the socialist economy and of raising the living standards of the Soviet people was a most vital state objective.

At the 25th Congress of the CPSU it was once more emphasised how necessary and important it was to work out and implement measures to protect the environment and for rational use and reproduction of natural resources. In the Guidelines for the Development of the National Economy of the USSR 1976-80 it is planned, in particular, to "monitor the state of the environment and the sources of its pollution.... To improve the techniques of forecasting the effects of production on the environment and take into account its possible consequences in preparing and adopting project designs."[1]

In addition to protecting the environment on its own territory the Soviet Union, as a country in which communist society is being built, also has an interest in protecting the environment all over the world, including the oceans, the atmosphere, and the biosphere, since planetary natural processes are indivisible between socialist and capitalist countries. The Report of the Central Committee to the 24th Congress of the CPSU stated that the USSR was ready to take part in collective international measures to protect nature and use natural resources rationally. At the 25th Congress L. I. Brezhnev pointed out the importance of international collaboration for solving such pressing and important global problems as protection of the environment, the mastering of outer space, and use of the resources of the oceans. International measures in this respect are directly linked with the struggle for peace, since peace on earth and protection of the environment are indissolubly united.

Scientific forecasting of the consequences of the interaction of society and the environment must be many-sided, embracing both the development of natural processes and the economic and social aspects of defence of the environment. For it is impossible to stop the "mechanism" of extended reproduction of economic life, including extended reproduction of the exploitation of natural resources. The

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[1] *Documents and Resolutions, XXV Congress of the CPSU*, pp. 189, 190.

advances of the scientific and technical revolution (which bourgeois writers blame for the "ecological crisis") are making it possible to reconstruct industry along "closed cycles", with repeated re-use or recycling of water and of the wastes of technological processes. This reconstruction calls for vast capital investment, but socialist society is embarking on it, and measures to go over to "closed cycles" are already envisaged in the long-term plans of the USSR and other socialist countries.

Capitalist monopolies are striving, with the aid of the state apparatus, to transfer the outlays involved in going over to the new technology, and in purifying effluent, using industrial wastes, etc., onto the masses of the people. The people in turn are fighting this policy and demanding that the monopolies bear the cost. A sharp, anti-monopoly, class struggle of the masses of the people for a clean environment is developing. And in a number of cases the working people and working class have had success in this struggle.

The problem of the environment has thus become one of the most important problems of the modern world. On its solution depend reproduction of the population and its health, work, well-being, and future. Man's harmonious development is impossible without constant interaction with the whole life of nature, with clean seas, rivers, and lakes, forests, meadows, and parks, and with the animal kingdom. Mankind cannot develop normally on the shores of dead seas, or draw water from rivers converted into sewers, or breathe smoky air. The problems of population and the environment are now interwoven and constitute a single whole.

Only communism, when the real history of mankind begins, can tackle the hitherto unresolvable problems of population, subordinate industry and defence of the environment to the interests of man, free man from social servitude, create the conditions for real freedom and real domination of nature, and determine the optimum relation between reproduction of population in the world as a whole and in the separate regions and natural possibilities of humanity's cradle and sphere of activity, the Earth.

Chapter 3

ENERGY AND NATURAL RESOURCES

V. P. Kovalevsky, Cand. Sc. (Geog.),
A. A. Mints, D. Sc. (Geog.)

The present level of development of the productive forces is closely linked with obtaining a variety of raw materials from nature and the use of vast amounts of energy. The whole course of economic development in recent centuries, especially in the present one, indicates that energy and raw material resources have acquired decisive importance as the natural prerequisites of economic growth and improvement of the people's prosperity.

Area-wise energy and raw material resources are most unevenly distributed; hence the great differences and sharp contrasts in the degree to which separate countries possess them. Some countries have very rich reserves of valuable resources both in absolute terms and per capita, while others, on the contrary, have only modest natural resources at their disposal, and not always successfully combined.

The uneven provision of natural wealth is exacerbated by the distorted forms of areal division of labour brought about by the capitalist world market and the policies of imperialist states and monopolies. At the same time the unevenness of the distribution of resources, which is far from compensated by foreign trade and other forms of international economic relations, is an important objective factor in economic development that must be fully allowed for when deciding on a differentiated population policy.

The process of continuous increase in the degree of society's interaction with its environment in the course of producing material wealth has become particularly clear in recent decades in connection with the scientific and technological revolution.

Growth in the volume of exploitation of long-known types of resources is combined at present with rapid extension of the range of the natural materials and substances being transformed into resources by the latest advances of science and technology.

In addition to the absolute increase in the use of natural resources there is also a gradual diminution of the proportion of the corresponding sectors of the economy (extraction in the broadest sense of the term, or "primary" sectors) in the total volume of social production. An ever smaller fraction of the population engaged in the economy is involved in extracting products from nature needed for production and consumption purposes, while the proportion of newly created national income derived from these sectors of the economy is gradually diminishing. The reason is primarily the rapid development and complication of the successive stages of processing primary natural products into objects of final consumption.

An idea of the scale and trend of development of these processes is given by estimates made by the Institute of Geography of the USSR Academy of Sciences. According to figures relating only to the USSR and the USA, total extraction of the principal natural materials in the two largest countries of the world rose from 2,800 million tons in 1913 to 7,200 million tons in 1960. According to the same estimates, per capita consumption of all primary natural materials will reach 35 to 40 tons in the observable future. Consequently, for the world to reach the level of economic development now characteristic of the most industrialised countries the total volume of matter extracted from nature will have to be tens of thousands of millions of tons.

Geographically, on a world scale, real differences are to be observed in the relative significance of the "primary" sector, differences associated both with socio-economic and with natural factors.

Neither the quality of natural resources of one kind or another, nor their composition directly determines the

rates or character of the socio-economic development of countries and regions, though it has a great effect on them. There is no doubt that the possession of quite large and varied resources is an extremely important potential for ensuring economic independence; but the experience of rapid economic development in a number of capitalist countries indicates that lack of many resources on their own territory was not an absolute obstacle to the development of their economies. These countries, however, are still dependent on the international situation, the state of the world market, transport communications, and so on.

Since natural resources are the most fixed localised factor in the distribution of the productive forces, their spatial distribution and the character of their areal combinations strongly affect the industrial specialisation of various countries, living standards, and also the direction of economic ties, forms of settlement, etc. The concrete forms of this influence, however, are historically conditioned since they are always mediated through the mode of social production, which reflects the level of development of the productive forces attained and the given relations of production.

As regards the areal distribution of social production, given certain socio-economic conditions, the force of natural factors largely depends on the techno-economic features of the branch of industry concerned.

The branches of industry and production of the "primary" type most closely tied to sources of natural resources are the extractive industries and agriculture. For them the actual volume and quality of the natural resources possessed by a country operate as a *sine qua non* of development.

Industries not directly linked with the use of natural resources but concerned with processing primary products into end products are much less rigidly tied, as a rule, to given natural areas and points. In addition, modern technology (the growing capacity of single units) is increasingly dictating a need for considerable concentration of production. The building of many types of manufacturing enterprise (iron and steel works, oil refineries, chemical works) proves to be economically advisable only on condition that there is a sufficiently large market for the product in the surrounding area.

In some countries, especially in those dependent on foreign capital, only the "primary" levels exploiting natural resources and the minimum network of necessary services (infrastructure) are developed under its influence. Foreign capital itself does not go into setting up the whole complex of manufacturing and attendant industries associated with local raw materials. Some writers think that the formation of a special type of mineral raw material and agricultural area in such countries is a consequence of this.

The territorial separation of the "upper" stages of the processing of natural materials from their sources, and their concentration in economically advanced countries, lead to the bulk of the profits obtained from exploiting the natural wealth of the source countries (raw material bases) being drawn to the advanced countries, so that there is often a great loss of valuable resources to the source countries as a result of this one-sided, predatory approach to the exploitation of natural wealth (non-utilisation of oil gases in petroleum production and of valuable admixtures in the mining and concentration of ores, and so on).

In functioning as bases for the development of industry, in particular of industries that determine a given country's specialisation, energy and raw material resources, it should be noted, are an important link in the system of factors affecting the way the food problem is tackled. A high level of industrial development relying on local resources provides more or less considerable foreign exchange opportunities for importing foodstuffs. The same result can be achieved by home industrial production of producer and consumer goods. Finally, industrialisation that relies on local resources but is not limited by them creates the basis for technical re-equipment of agriculture and consequently for a rise in home production of foodstuffs.

On the whole we can say that a high level of energy and raw material resources is an important factor in the development of the productive forces, and on that basis in raising the people's living standards, improving the productivity of agriculture, and taking advantage of active involvement in the international division of labour.

Certain specific features of those industries that are linked with exploiting natural resources need to be noted, above all their high capital intensity, i.e., the need for large outlays on prospecting, exploring, and studying resources, and on building extraction and mining undertakings and creating a complex of transport facilities. These industries call for much higher capital investment per unit of output and per worker employed than many manufacturing industries. At the same time they are distinguished, as a rule, by low labour intensity.

Important socio-economic consequences stem from that, especially for developing countries. The opening up of their natural wealth usually calls for major capital investment; developing countries therefore require aid. The Soviet Union and other socialist countries, as is known, are extending them great assistance in mastering energy and raw material resources, sending specialists and machinery to them, and building undertakings and industrial complexes. At the same time the imperialist monopolies, exploiting precisely this resource sector, are building their jumping points for penetrating the economy and subordinating the whole economic structure of the countries concerned to their interests.

A high level of capital expenditure per job under capitalism means that resource industries contribute little to solving one of the most pressing problems of countries with high population growth rates, namely that of overcoming unemployment. Working of natural resources can only contribute actively to eliminating unemployment when it is accompanied with the development of a whole complex of modern industries, including labour-intensive ones turning out finished products. The building of such complexes in developing countries, however, involves serious economic difficulties and takes a long time.

The drawing of industrial natural resources into circulation and the building of major extractive, power, and processing industries (iron and steel, basic chemicals, etc.) cannot always be considered the key link in industrialisation, especially when it is a matter of the most urgent measures. This trend in economic development often proves expedient at later stages, when the most acute and pressing problems have already been tackled.

At today's technical level the key group of resources is the fuel and power group. This is due to the enormous energy-intensity of all production processes and the rapid growth of power consumption in the non-productive sphere. At the same time the use of most types of mineral fuels is combined with obtaining valuable industrial raw materials (especially chemical ones) while the exploitation of hydro-electricity is often part of the complex, integrated use of water resources.

Total world consumption of power resources rose ten times between 1860 and 1960, from 550 million tons of standard fuel to 5,000 million tons. Mean per capita consumption rose from 0.46 ton of standard fuel to 1.66 tons between 1900 and 1960. In connection with the higher efficiency of power installations the fraction of energy usefully employed has risen 2.5 times, so that total useful power consumption rose 23-fold in the century 1860-1960, and energy per capita ninefold. It is forecast that per capita power consumption will be between 3.5 and 4.0 tons of standard fuel in the year 2000, and total consumption between 22,000 and 25,000 million tons.

As was noted at the 7th World Power Conference held in Moscow in 1968, world consumption of power resources rose from 2,900 million to 5,900 million tons of standard fuel in the period 1959-66 alone.

The mastering of power resources as a rule creates the basis for general economic development for a country as a whole and for separate areas. The fuel and power sector is one of the most asset-intensive areas of the economy, absorbing a considerable part of the capital investment directed to economic development.

In some areas the exploitation of power resources often becomes the main core around which the other elements of a production complex are built (e.g., the Angara-Yenisei area in Siberia; the basin of the Columbia River in Canada; the High Aswan Dam in Egypt).

The inadequacy and incomparability of the data on the various forms of fuel and power resources render it extremely difficult to make a global estimate of world power potential with any accuracy; but an attempt to define reserves of mineral fuel was made in the material on power resources prepared for the 7th World Power Conference.

Total geological reserves of mineral fuel are estimated at 10 to 25 million million tons of standard fuel, of which 3,400,000 million tons can be extracted with economically justifiable outlays, which is 640 times the present-day annual level of extraction.

Total geological reserves of oil are estimated at around 200,000 million tons; allowing for the use of secondary methods of extraction total reserves would be 430,000 million tons. Proven reserves are estimated at 53,000 million tons, with a tendency for reserves to grow faster than extraction, so that available oil reserves are increasing (in 1970 they were estimated at between 60,000 and 65,000 million tons).

According to the data of the 7th World Power Conference, more than 60 per cent of proven oil reserves are concentrated in the Middle East (Kuweit, Saudi Arabia, Iran, Iraq, etc.), 19 per cent in the Americas (USA, Venezuela, Canada), and 8 per cent in Africa (Libya, Algeria, Nigeria).

World extraction, which began in the middle of the nineteenth century, has led to the drawing of 22,000 million tons of oil from the interior of the earth.[1] Extraction rose from 20 million tons in 1900 to 298 million tons in 1940, and to over 2,300 million tons in 1970. The proportion of oil in the structure of world production of primary power resources rose from 2 per cent in 1900 to 33 per cent in 1965.[2] It is estimated that the figure will reach 47 to 55 per cent in 2000 A.D.[3]

The immense economic importance of oil as a source of motor fuel and as a chemical raw material determines its extraordinary value both for the main producer countries and areas (especially for those where, because of the low level of economic development, the extraction of petroleum is the foundation of the whole economy), and for the

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[1] See L. N. Nefedova. Changes in the Geography of Petroleum Production. In: *Trudy Moskovskogo instituta neftekhimicheskoi i gazovoi promyshlennosti* (Papers of the Moscow Institute of the Petrochemical and Gas Industry), Issue 66, Moscow, 1967, p. 67.

[2] See L. Tomashpolsky. The World Power Balance: the Problem of the Last Third of the Century, *Mirovaya ekonomika i mezhdunarodniye otnosheniya*, 1967, 2:26.

[3] See S. M. Lisichkin. Oil and Gas in the World's Power Resources, *Neftyanoye khozyaistvo*, 1971, 5:19.

world economy as a whole. Suffice it to note that a considerable part of world shipping is linked with the volume and distribution of petroleum extraction, and also many branches of the modern chemical industry.

World estimates of reserves of natural gas—a most valuable fuel and chemical raw material—are put at between 140 and 170 million million cubic metres, and reserves in explored fields at more than 40 million million cubic metres.

In connection with the extremely high rate of extraction of oil and gas, the supply of these resources for long-term future consumption is the subject of lively debate in the world literature. In the past, dates for the exhaustion of oil reserves were predicted more than once, but all these pessimistic forecasts proved unfounded in spite of the rapid growth of petroleum production.

According to L. G. Weeks' estimates, world initial extractable reserves of oil, i.e., oil already extracted plus explored reserves, are 270,000 million tons (given favourable conditions, world petroleum production may reach 4,000 million tons a year after 2000 A.D.). World initial potential reserves of gas are estimated at 170 million million cubic metres. For the whole world prospective petroliferous and gas-bearing lands have an area of some 30 million square kilometres, including 11.9 million in the USSR, 7.2 million in North America, 3.5 million in South America, and 3.5 million square kilometres in the Middle East. On the basis of these estimates, given an average level of extraction two or three times higher than at present, the world will be assured of oil for 130 to 150 years, and of gas for a longer period.

Proven world reserves of coal, which until recently occupied a decisive place in the fuel balance, and even now is very important, are estimated variously at 600,000 to 2,400,000 million tons, and geological reserves at between 7,500,000 million and 14,000,000 million tons. The USSR, USA, West Germany, China, and Great Britain are leading coal countries by the extent of their reserves. Extraction of coal, unlike the extraction of oil and gas, has remained relatively stable on a world scale, or has even fallen slightly.

Other forms of fuel resources (peat, shale, wood) do not play an essential role in today's world fuel and power

balance, although their place in the economies of individual countries and areas may be quite marked.

Rapid development of atomic power engineering began in the 1960s. Electricity from atomic power stations is already competitive with current from thermal stations working on "normal" fuel.

At the beginning of 1971 the world capacity of operating atomic power stations was 19,649 megawatts, of stations under construction 102,583 megawatts, and of planned stations 195,797 megawatts.[1] Almost all the stations then under construction were commissioned in 1972, while the planned ones will be commissioned by 1980. Whereas atomic power stations accounted for only 1 per cent of installed generating capacity in 1968, by 1975 the figure had risen to 7 per cent, and by 1980 will be about 15 per cent.[2]

Resources of radioactive minerals have become particularly important with the rise and development of the nuclear power industry. The heat content of geological reserves of uranium is 320 times greater than that of the geological reserves of fossil fuels, while the heat content of reserves of thorium is 450 times greater. According to available estimates, proven reserves of uranium in non-socialist countries are 1,680,000 tons, and the most economic reserves (under ten dollars per pound of U_3O_8) around 640,000 tons. The largest reserves of uranium are concentrated in Canada, the USA, and the Republic of South Africa. Mining of uranium (production of uranium concentrates) in capitalist countries exceeds 20,000 tons.[3]

In contrast to all other forms of fuel, hydro-electric resources are renewable. It is difficult to estimate them on a world scale because of the lack of hydrological study of many areas. According to Soviet estimates, the probable theoretical gross hydropotential of the world is 3,750 million kw of capacity and 32,900,000 million kwh of annual

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[1] *The Economist*, 1971, 239, 6660:62-63.

[2] See *Ekonomicheskoye polozheniye kapitalisticheskikh i razvivayushchikhsya stran. Obzor za 1968 g, i nachalo 1969 g.* (The Economic Situation in Capitalist and Developing Countries. Survey for 1968 and the Beginning of 1969), Moscow, 1969, pp. 24-25.

[3] See N. S. Sazykin. *Syryeviye resursy uranovoi promyshlennosti kapitalisticheskikh stran i ikh ispolzovaniye* (The Raw Material Resources of the Uranium Industry of Capitalist Countries and Their Exploitation), Moscow, 1968, pp. 8-9, 41.

generation of power. Asia is richest in hydro-electric resources (36 per cent); then follow Africa and North America (19 per cent each), South America, Europe, and Australia.

The exploitation of hydro-electric resources occupies a comparatively modest place in the world power balance, although it is very important or even decisive in individual countries (Canada, Japan, Norway, Sweden, Finland, Italy, etc.). Thus, in 1965, only 5.9 per cent of the total power generated was attributable to this source (by 2000 the figure will probably fall to 2.4 per cent).

As regards such power resources as solar energy, winds, marine tides, and geothermic ("exotic") sources, there is in general little basis for estimates. Their exploitation has either not been mastered technically, or has still no economic significance and remains simply at the experimental stage.

The rapid growth of power consumption has still only slightly affected the developing countries, whose share of world consumption is only around 7 per cent. It is estimated that average annual per capita consumption of power in socialist and economically developed capitalist countries will be six or seven tons of standard fuel by 2000, and in developing countries 2.0 to 2.5 tons. The decisive role in meeting it will be played by oil, gas, and nuclear energy (25.8 per cent each) and by coal (18.5 per cent), followed by hydro-power (2.4 per cent), wood and peat (1.5 per cent). Only an insignificant fraction will come from tides, geothermal sources, and solar energy.[1]

The growing production of implements of labour, consumer goods, and various structures calls for vast quantities of various natural materials (metals, dispersed elements, and non-metallic raw materials for the chemical, building, and other industries).

In the ever-widening range of metals used, iron and steel are still the most important both as regards volume of production and economic role. The total estimated reserves of iron ore (the main raw material of the iron and steel industry) are put at 3,500,000 million tons, and proven reserves at more than 100,000 million tons. The

[1] See L. Tomashpolsky. *Op. cit.*, p. 28.

world total of iron ore mined exceeds 600 million tons a year.

Among the non-metallic minerals, the most important as regards scale of exploitation are the "agronomic ores", i.e., the raw materials for producing artificial fertilisers.

Some non-metallic minerals are of great importance in other branches of the chemical industry. Thus the non-socialist world's reserves of sulphur are put at 502 million tons, and proven reserves at 190 million tons. The largest reserves of natural sulphur are found in the USA, Mexico, Italy, and Japan.

The world total of timber supplies in 1960 was more than 1,700 million cubic metres. With the diminishing proportion of commercial timber, and the marked superseding of wood in building, pulp-and-paper production is growing rapidly, and also the chemical processing of wood and other progressive industries. According to the data of the Food and Agricultural Organisation (FAO), annual consumption of commercial timber rose from 981 million cubic metres to 1,429 million between 1957 and 1970, of wood fuel from 861 million cubic metres to 1,044 million, and the total from 1,842 million to 2,472 million cubic metres.

The availability of timber resources varies greatly from country to country. In a number of countries lying in the temperate and tropical zones (the USSR, Canada, USA, Sweden, Finland, Brazil, Indonesia, Burma, etc.), forests cover a considerable part of their area; but in many areas of the world, especially those lying in the steppe (savannah), semi-desert, and desert belts, there are practically no timber resources at all (see Table 24).

Water resources have come to be of paramount importance in recent years. In many countries, especially in the economically developed ones, meeting the water needs of the public and of the economy has become a most important scientific, technical, and economic problem. The specific nature of water resources dictates a need for a complex approach to solution of the problem, and necessitates rational distribution (and occasional redistribution) of water resources by industry and area in accordance with their role in economic development.

Since most countries and areas did not, until recently, suffer from a shortage of water, adequate steps were not

Table 24

The World's Timber Resources

Region	Total area (millions of hectares)	Area of forests accessible for exploitation (millions of hectares)	Percentage wooded	Timber reserves* (millions of cubic metres)	Average reserves per hectare of forest (in cubic metres)
Europe (without the USSR)	141	138	30	10,780	80
North America	733	400	39	36,640	100
Central and South America	1,031	332	51	9,380	80-115
Africa	753	380	25	5,620	45
Asia (without the USSR)	520	326	19	22,020	100
Australia and Oceania	96	26	11	1,320	65
USSR (Soviet estimates of the forest fund)	836	836*	37	42,813	94
Total	4,110	2,438	31	128,573	91

* The estimates include only worked forests. The total timber reserves in all forested areas constitute 160,000 to 180,000 million cubic metres.

Source: P. V. Vasilyev. Forest Resources and Forestry. In: *Prirodniye resursy Sovetskogo Soyuza, ikh ispolzovaniye i vosproizvodstvo* (Natural Resources of the Soviet Union, Their Use and Reproduction), Moscow, 1963, pp. 137-38.

taken to estimate resources on a world scale. In order to organise international co-operation to study and estimate them, the International Hydrological Decade was instituted in 1965 under the aegis of UNESCO. The data available at the time of writing on the geographical distribution of world water resources were rather tentative. The total has been put at 1,460 million cubic kilometres. The distribution of this immense volume by principal sources can be represented as shown in Table 25.[1]

The most dynamic category of water supplies, and that most widely used, is river flow (run-off), which constitutes

[1] See M. I. Lvovich. Water Circulation and Resources. In *Krugovorot vody* (Water Circulation), Moscow, 1966, p. 105.

Table 25

Simultaneous Water Resources in the Various Stages of the Hydrosphere (after Lvovich)

Forms of the hydrosphere	Cubic metres (thous).	Percentage
Oceans	1,370,323	93.8
Underground waters	60,000	4.1
Glaciers	29,000	2.0
Lakes	750	0.05
Soil moisture	75	0.005
Atmospheric vapour	14	0.001
River water	1.2	0.0001

only an insignificant part of the mass of water on Earth. Nevertheless it is considered the principal part of water resources at the present time.

Total river flow from the land is estimated on the average at 37,317 cubic kilometres a year. This quantity is distributed by continents as follows (in cubic kilometres):

Asia (and islands)	12,850
South America	7,904
North America (including Central America, Greenland and the Canadian Arctic Archipelago)	6,087
Africa (plus Madagascar)	4,657
Europe (less Iceland)	2,844
Australia (plus Tasmania, New Guinea, and New Zealand)	1,919
Antarctica	1,056

The data reviewed here show quite clearly that the volume of the world's power and raw material resources even at the level of study of the time of writing, and at the existing technical level of utilisation of natural wealth, is exceptionally large, and will satisfy very rapidly increasing economic requirements for decades and centuries to come. Mastery of major new sources of energy and raw materials on the basis of scientific and technical advance (use of thermonuclear energy, penetration of deep-lying layers of the Earth's crust, exploitation of the wealth of the oceans) may already, in the foreseeable

future, increase the Earth's potential resources to a significant extent.

In addition, there are, geographically, differences in the resources of various countries, due to objective causes, differences that are sharpened by profound and increasing inequalities in their socio-economic and technical levels. The widening of the gap between the economically developed and developing countries does not allow the latter to utilise advanced scientific and technical achievements and so increases their relative poverty in natural resources

The objective difficulties in tackling the existing problems of providing resources for the economies of many nations are being aggravated by the consequences of the imperialist division of the world, the forms of inter-monopoly competition inherent in capitalism, and the exploitation and oppression of developing countries by imperialist powers. As a result rapacious exploitation of natural wealth, pollution of the environment, neglect of the future interests of humanity, and the impossibility of a rational division of labour and organisation of joint efforts to master the Earth's resources are characteristic of capitalism. Therefore only a radical reconstruction of socio-economic relations and the organisation of scientific and technical co-operation on the basis of real international mutual aid can provide a radical solution of the problems of using the planet's natural wealth in the interests of all humanity.

Chapter 4

FOOD RESOURCES

V. P. Kovalevsky, Cand. Sc. (Geog.),
A. A. Mints, D. Sc. (Geog.)

"Eat to live and not live to eat," the old proverb says. The amount of food needed by the human organism to sustain normal life activity varies in respect of many factors; those who dwell in northern regions need more food than those in the tropics, adults need more than babies, lumberjacks more than clerks. In estimating a population's needs for food, researchers employ averaged indices. Josué de Castro took 3,300 Cal. a day as the average norm,[1] Dudley Stamp around 2,500 Cal. a day,[2] and other researchers 2,700 to 2,800 a day. FAO experts have worked out regional norms that are higher for Europe than for Africa.

Not only is the total amount of energy needed by man in the form of food important, but also the ratio of its main components. In the opinion of the experts at least 14 per cent of man's food energy should be obtained from proteins (and around 34 per cent of that quantity should be from protein of animal origin), 30 per cent from fats, and 56 from carbohydrates. The daily intake should also contain a certain amount of vitamins and elements like iodine, iron, phosphorus, calcium, etc. A marked disturbance of the ratio of the various constituents, a lack of vitamins, or a low total calorie intake leads to serious

[1] Josué de Castro. *The Geography of Hunger*, Boston, 1952.
[2] L. Dudley Stamp. *The Geography of Life and Death*, London and Glasgow, 1964.

consequences; the organism becomes emaciated, fitness to work is lowered, and specific illnesses develop. The best known hunger diseases are kwashiorkor (which afflicts children in tropical areas as a consequence of protein hunger), beri-beri, scurvy, pellagra, and night-blindness. All these diseases and ailments are common in countries where rice, maize, or millet is the staple of the people's diet, and meat and dairy products are almost absent. Certain diseases are also caused by avitaminosis.

The Belgian scientists P. Duvigneaud and M. Tanghe have calculated that mankind takes a somewhat smaller amount of food from the biosphere than it needs for normal nutrition.[1] The deficit is not uniformly spread; while the population of some countries, or of whole regions, is well or satisfactorily fed, in other areas it is starving.

Thus, daily per capita consumption is 850 Cal. higher in countries with a high level of economic development than in developing countries. In South and South-East Asia it is 1,200 Cal. less than in Australia or New Zealand. The average daily consumption of animal protein per capita in the USA is 8.3 times as high as in the Far East, six times as high as in Africa, and 4.7 times as high as in the Middle East. In economically developed capitalist countries per capita consumption of protein is 90 grams a day, 50 per cent of it animal protein, while the daily consumption in developing countries is only 60 grams, of which 15 per cent is animal protein. While an inhabitant of Java receives 100 Cal. a day of animal origin, an American receives 2,200. According to FAO estimates, 60 per cent of the families in developing countries are not adequately fed, which constitutes around half of all humanity. Among the strata of the population worst provided for, daily consumption falls to between 1,500 and 1,300 Cal.

Geographically one may quite justly speak of the existence of a "hunger belt" in which the majority of the population suffers from various forms of malnutrition (energy, protein, vitamin, or mineral). This belt embraces a vast territory on the map of the world lying mainly in the tropics and partly in subtropical regions.

[1] P. Duvigneaud and M. Tanghe. *Ecosystèmes et biosphère*, Bruxelles, 1967.

In the "hunger belt" calorie deficiency is usually combined with a lack of certain important dietary constituents, primarily animal protein. There are quite extensive regions, however, where the population, eating mainly cereals and roots rich in starch, get an adequate number of calories, but almost completely lack meat, milk, or fruit. That is the situation, for example, in the interior of tropical Africa, India, and Indonesia. Even in some European countries (Spain, Italy, and Portugal) average per capita consumption of animal protein is below the necessary norm.

The fact that the "hunger belt" mainly embraces tropical and subtropical areas does not mean, of course, that it is due to local features of the natural environment. The development of agriculture encounters difficulties there, of course, that are not known in temperate regions; the many types of leached soil have a low natural fertility, are easily eroded, and recover their fertility slowly, while carriers of various diseases that interfere with human life and prevent the introduction of farming are common (e.g., the tsetse fly in tropical Africa); the grass cover of the savannah is only good for productive cattle during its initial growth period, and so on. At the same time one may quite justifiably speak of certain advantages of these regions. The temperature conditions, for example, make it possible to raise several crops in a year.

The inadequate diet of the population is a phenomenon linked rather with socio-economic conditions than with natural ones. There are also, with reason, foci of poor diet in industrial capitalist countries where the average per capita standard of food consumption is high. These centres of hunger are places where there is a concentration of low-income population, like the Black ghettos in the cities of the United States, or the so-called depressed areas of many capitalist countries.

Countries located within the "hunger belt" were colonies and semi-colonies of the imperialist powers in the recent past. Long political and economic enslavement led to a retarding of their economic development and to one-sidedness and distortion of their economic structure, and gave rise to such a degree of backwardness and poverty that it is only being overcome with the greatest difficulty at the present time. The legacy of the period of colo-

nial dependence has several common features, namely: a low per capita income; the survival of feudal and tribal customs among agrarian strata; low marketability of peasant farming; a primitive technical basis for agriculture; agrarian surplus population; weak development of towns and manufacturing industry; lack of development of inter-regional trade, and so on. It was this complex of causes, engendered or sustained by the colonial regime, that gave rise to the "hunger belt".

The economic backwardness of the former colonies and semi-colonies is manifested, in particular, in their volume of agricultural production not corresponding to the size of their population. More than 70 per cent of the world's population live in Asia, Africa, and Latin America, but they produce less than half the world's farm produce. The growing of export industrial and food crops (cotton, sugar cane, cocoa, coffee, tea, bananas, etc.) has an extremely high weight in the farming of developing countries. In the middle of the 1960s foodstuffs and agricultural raw materials on average constituted more than 50 per cent of the value of the exports of developing countries, and in some of them 80 to 90 per cent. Foreign capital was directed primarily to plantation farming, the plantations being distinguished by a relatively high level of technical equipment, while the production of food for home consumption was based on backward, patriarchal peasant farming. Since the export of agricultural raw materials still remains almost the sole source in many developing countries for obtaining funds to develop industry, transport, and other needs, the necessity of maintaining and extending this sector somewhat limits opportunities and efforts to extend food production for home consumption.

The winning of political independence and the forming of a big group of sovereign, developing countries in the place of the former colonies and semi-colonies, has created objective conditions for overcoming economic backwardness, and in particular for improving the diet of the people in the zone with an unfavourable food situation.

In the years since World War II per capita consumption has risen a little in many of the "hunger belt" countries; but this rise has often been linked not so much with de-

velopment of their own agricultural production (which as a rule is only outstripping the rate of population growth to an insignificant degree) as with shifts in international trade in foodstuffs. The fact is that many of the present developing countries were not only exporters of tea, coffee, or cocoa before World War II but were also exporters of food grains. Thus Asia's net export of rice in 1934-38 was two million tons, and of maize 500,000 tons (with net wheat imports of 900,000 tons). Africa exported 100,000 tons of wheat, and Latin America 1,800,000 tons of wheat and 6,500,000 tons of maize. Since the war the developing countries have become large importers of food grains. At the end of the 1960s India, for example, was buying up to ten million tons of wheat.

Food purchases were the way the new sovereign states tried to improve the food situation of their people, as the growth rates of home production were inadequate for the purpose. It was a forced measure, of course, since the diversion of income to expenditure put a heavy burden on the new states' budgets. At the end of the 1960s and beginning of the 1970s a certain turning point was noted in the supply of cereals in some "hunger belt" countries. The spread of new high-yielding varieties of wheat (India, Pakistan) and rice (Indonesia, the Philippines) may perhaps, in the not distant future, resolve the problem of self-sufficiency in grain in a number of developing countries, ending their dependence on imports. That will be a real victory on one of the sectors of the battle against hunger. The fight to improve the diet of the people of Asia, Africa, and Latin America, one must remember, is being waged in a very specific situation, and is complicated by several processes. One of the latter is the "population explosion". As is well known, government measures in the health field in developing countries have led to a marked drop in mortality since World War II (primarily in infant mortality), and consequently to acceleration of the rate of natural increase. A mean annual rate of increase of 2.0 to 2.5 per cent, and even of 3.0 to 3.5 per cent, is a phenomenon common to almost all developing countries in our day. In these conditions even the task of maintaining nutrition at the former low level has necessitated such growth rates of food production in agriculture as it has never known before.

The overwhelming majority of developing countries are coping with this task successfully, but the high growth rates have proved inadequate to improve nutrition to any marked degree. It has been found, moreover, that the food production growth rates are lagging behind the growth of effective demand for it. In spite of all these economic difficulties, developing countries have often achieved quite a marked increase in per capita national income. In countries with a low per capita income food is distinguished by high elasticity of demand. In other words, a slight rise in per capita income causes a relatively high growth of demand for food as an object of prime necessity.

The accelerated growth rates of demand for food are also associated with urbanisation. The growth of towns is an almost universal phenomenon, the increase of the urban population often outstripping that of jobs in the towns. Urbanisation presents definite demands on agriculture, especially on its marketability. But given the predominance of traditional ways of farming, marketability increases very slowly and the towns often acquire "extraterritoriality" in relation to the hinterland, orienting themselves on imported food.

Evidence of the low marketability of traditional farming is the fact, for example, that one person working in agriculture in Ghana feeds only 1.5 persons, in Nigeria 1.2 persons, but in the United States 44 persons.

Humanity's food supply is mainly based on tillage, which provides 88 per cent of food energy. Around 10 per cent comes from grazing, and only 2 per cent from the oceans. Thus the life of nine-tenths of the world's population depends on 10 or 11 per cent of the land area, which yields about 16 or 17 per cent of the organic material produced by the whole land area of the Earth.

The productivity of the ecosystems associated with man (tillage) or strongly affected by him (grazing) depends to a certain extent on natural factors (the balance of warmth and moisture; the natural fertility of soils, etc.), but the decisive factors are circumstances of a social, historical, economic, scientific, and technical order. Unlike natural ecosystems, anthropogenous ones are not self-regulating, and in order to maintain high productivity, and in the main to ensure growth of productivity,

they call for man's continuous positive intervention, which is manifested in large, ever increasing capital investment per unit of area. The possibility of such outlays is the greater, of course, where the general standard of economic development is higher. The productivity of anthropogenous ecosystems on the world map is therefore a complicated mosaic, varying within one and the same natural zone according to territorial differences in socio-economic conditions.

If we take food resources as a derivative of the land resources of an area and of the degree to which they are used, we can distinguish several main types of "man-food resources" relations, as follows:

(1) territories with a relatively low per capita availability of land and highly intensive use of land resources, with a high technical equipping of agriculture (output per unit of tilled land, and per head of population, is high, a circumstance that makes it possible to employ the greater part of the produce of crop-growing as fodder for cattle, expending seven "vegetable" calories to obtain one "animal" calorie); the diet of the population is well balanced, and although self-sufficiency is not achieved in all types of food, some of the produce is available for export; further intensification of farming makes it possible to count on an improved food balance (this type is characteristic of Western Europe, and is almost never encountered in developing countries);

(2) territories with a high per capita availability of land, and an average intensity of land use, with high technical equipment of agriculture (e.g., the United States, where output per unit of land tilled is much lower than in Europe but productivity per person employed is much higher); output per head of population is higher than in countries of type 1, agriculture has a bias toward animal husbandry, and there are great surpluses of meat, grain, and fodder for export; the diet is well balanced; there are considerable reserves for increasing production through intensification (Canada, Australia, and some areas of Latin America can be included in this type);

(3) territories with a very low per capita availability of land, a relatively high intensity of land use, and a very low technical equipping of farming (ancient land culti-

vation, accumulated habits, and an enormous outlay of labour enable very large harvests to be obtained per unit of land, but output of produce per head of population is low); the low per capita yields limit opportunities for raising fodder for productive animal husbandry; starchy foods dominate the diet, which is ill balanced and low in calories; the food balance is very tight; food is imported but it cannot overcome the lack of food in the country, the outlook for extending food production is largely linked with further intensification and reconstructing of the technical basis; opportunities for extending the crop area are often limited (this type is characteristic of India, certain parts of Indonesia, namely Java, Burma, the Philippines, etc.);

(4) territories with a relatively high per capita availability of land and a low intensity of land use, with extreme technical backwardness of farming; output is low both per unit of land and per head of population; starchy crops predominate; the productivity of cattle is low, and fodder resources poor, pastures being of low quality; the dominant system of landworking is slash-and-burn; as the density of population increases the period that land remains fallow is reduced, which often leads to a lowering of fertility and the development of erosion; the food balance is tight, especially as regards protein of animal origin (this type is characteristic of many countries in Africa, and of several Latin American and Asian countries).

The problem of whether the unfavourable "man-food" ratio in the third and fourth types of area, very common in the "hunger belt", can be altered does not in itself raise any qualms. The pessimistic thesis advanced by Malthus at the end of the eighteenth century on the incapacity of humanity, and of its knowledge and technique, to break the fetters imposed by limited natural resources has long been refuted by the course of historical development itself. Since his gloomy forebodings the population in industrially developed countries has more than doubled, but that has not brought about the consequences that he predicted. Scientific and technical progress has made it possible to maintain tempos of population growth. In the period 1954-56 to 1966-68 alone the population of North America rose by 18 per cent, and production

of cereals by 35 per cent. In Western Europe the corresponding percentages were 10 and 39 per cent. In the socialist countries the outstripping pace of development of agriculture was even greater. Even in economically backward countries the growth rate of cereal production has kept up with the pace of population increase (41 per cent), in spite of the "population explosion" situation and low technical level.

The problem is not whether or not hunger can be banished from the Earth but how, in what way, and in what period this can be done.

In coping with the food problem, mankind employs several methods, and will continue to do so. One is to extend the area of anthropogenous ecosystems, i.e., of tilled land. There are many different estimates of what land resources there are at man's disposal; they have one common fault, namely, that they are based on estimates and not on exact initial data, i.e., on the detailed soil surveys, and land and water registers, that are needed for that purpose. Hence the great inconsistencies in the results of the calculations.

The Americans Pearson and Harper consider, for example, that mankind has already ploughed up all the land useful for this purpose, that there are practically no reserves, and that the area of arable land needs to be reduced rather than increased in order to bring it into line with the area of land of optimal quality.[1] Fritz Baade suggests that 50 per cent of the land area of the world could be used for agriculture, while K. M. Malin puts this figure as high as 70 per cent. In our view the first forecast is clearly understated, while the other two are exaggerated. The fact is that the demand for land does not come solely from agriculture. Given the world population assumed by Baade and Malin, urban and industrial construction are very real competitors for the use of land resources. In addition, as numbers grow and their concentration in cities increases there must also be a steep increase in the need for recreation zones for their inhabitants. Finally, one can hardly forget the need to preserve forested areas and soil and water conservancy

[1] F. A. Pearson and F. A. Harper. *The World's Hunger*, Cornell University Press, Ithaca, N.Y., 1945.

zones, since the function of forests is by no means limited to supplying timber (which may in time be replaced by synthetic materials).

One must also bear another aspect of the problem in mind, which makes such far too optimistic calculations unrealistic. During the long development of nature, ecosystems have been built up that are best adapted to the conditions of the area where they are found. These natural ecosystems are self-regulating ones of a most complicated type. When man transforms a natural ecosystem by his agricultural activity, he alters the character of the former connections, so creating an anthropogenous ecosystem. In biocoenoses built up in extreme conditions (lack of moisture, steep changes of temperature, broken relief, etc.), disturbance of the relations within the natural ecosystem can lead, and often does, to the action of elemental forces beginning to be felt especially sharply and strongly. Occasionally it leads to degradation of the area (growth of gullies, salination, dust storms, fall of the water table). For any definite level of development of the productive forces, therefore, land resources must be divided into categories depending on their "permissible capacity". These may include land suitable for working without essential measures being taken to protect it; but there may also be land that it is profitable to use in forms as close as possible to the natural biocoenosis (reafforestation, pastures with limited grazing, hunting grounds, recreation areas).

These forms of use, incidentally, while preserving the land fund for the future generations, may also prove to be economically more profitable than more intensive forms. Experts consider, for example, that a regulated hunting economy may prove more efficient on the African savannahs than cattle-raising. The biomass of the fauna of wild ungulates is 350 quintals per square kilometre in many African reservations, while the grazing of cattle in analogous conditions yields only 35 to 60 quintals.[1]

Considering that the best land (as regards combination of the characteristics of heat and moisture balance, terrain, fertility, etc.) is actually cultivated, and that man had already long ago passed to cultivating lands of margi-

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[1] Jean Dorst. *Avant que nature meure*, Neuchâtel, 1965.

nal zones (i.e., with quite steep slopes, arid or wet, or of low fertility), the process of opening up new areas must be accompanied with a detailed estimate of their quality and the development of measures to protect them.

It may be supposed that in opening up lands of groups of low quality, an ever increasing area will be given over to other uses than farming.

Without going into a detailed discussion of this problem, we deem it proper to accept the more moderate estimates of land reserves for ploughing up. Thus the director of the International Institute for Amelioration and Land Improvement suggests that the area of tilled land can be doubled, i.e., raised to 2,800 million hectares, of which 400 million hectares are being used as pasture, 500 million hectares are covered by forest, and the rest are deserted. Some 800 million hectares are in developing countries, and the rest in economically developed countries. In Dudley Stamp's view, the area of arable land could be tripled.

The main way for many developing countries to increase food production at present is to extend the area of tillage. Their crop area has increased by nearly a third in post-war years. It may be supposed with adequate certainty that the ploughing up of new lands will play an essential role in the nearest future in combating hunger. But for all that this road will scarcely be decisive.

(1) Many countries and areas with a very high population density have comparatively small land resources. (2) Experience indicates that the economic effect of opening up land of the lowest category is very slight. (3) Even in countries where, as in Indonesia, overpopulated areas (Java) neighbour on underdeveloped areas (Kalimantan), organisation of the resettlement of considerable numbers of people proves a complicated business involving large expenditure.

It is thus difficult to expect that the ploughing up of new areas will attain rates significantly in advance of the rate of population growth. And one must consider, with Duvigneaud and Tanghe, that around 15 per cent of the tilled land in developing countries will go out of use in the next thirty years because of erosion, salination, etc.

A cardinal solution of the problem of providing developing countries with food lies along the line of intensifying

agriculture, and in bringing its productivity up to the level of the economically developed countries. It has been estimated that the raising of world yields to those of the most advanced countries for a given crop would enable 10,000 to 12,000 million people to be fed. And as we know, farm production is rising in several industrially developed countries although the area of arable is diminishing.

In most developing countries the productivity of agriculture is rising very slowly at present. Until recently most workers were very sceptical of the possibility of a steep rise in the yields of the principal food crops in a short period of time; but in recent years many articles have appeared in the Western press on the "green revolution" that will allegedly resolve the problem of food supplies for developing countries in a very short time.[1]

The development and spread of high-yield food crops is, without doubt, very important; but it is hardly possible to assess it as the decisive blow in the battle against hunger. (1) To obtain the full effect of the new varieties calls for a certain agro-technical reserve. They do not yield their proper effect without irrigation, fertilisers, and machine cultivation. Growing the new varieties of rice, for example, requires 30 to 35 per cent more water for irrigation than native varieties. Their general introduction necessitates not only considerable investment but also the accumulation of a certain amount of agro-technical knowledge. These varieties, offspring of the

[1] The term "green revolution" has gained currency among the workers of the International Centre for Improving Varieties of Wheat and Maize (Mexico) and the International Rice Research Institute (the Philippines), where new, high-yield varieties of these crops have been obtained. The new varieties are especially adapted to cultivation in lower latitudes, are resistant to disease, and respond much better than native varieties to irrigation and fertilisers. The adoption of new varieties of wheat in Mexican farming enabled the average yield to be raised in a few years from nine quintals per hectare to twenty-six. At the beginning of the 1970s short Mexican wheat had become quite widely grown in India (six million hectares), Pakistan (2,400,000 hectares), and Turkey (700,000 hectares). There have been reports that Pakistan is about to solve the problem of self-sufficiency in grain, and that India will attain this goal in the next few years. New varieties of rice have enabled the Philippines almost to end imports; they are also being quite widely sown in Indonesia.

period of scientific and technical progress, are intended for higher standards of farming than those common in many developing countries. (2) Even full provision of grain for the population cannot wipe out protein hunger, i.e., the lack of meat and milk in the diet. This problem presents great difficulties because not only is it complicated by a meagre fodder base and the spread of epizootics but it is also hampered by religious views (India) and customs (Africa).

There are great possibilities of increasing food production, in particular animal protein, through more intensive exploitation of the resources of the ocean. The total biomass produced by the productive layers of the ocean is many times greater than that of the land, but it still plays a very modest role in human nutrition. Only the very last stages in the unusually complicated food chain of the ocean, in the form of fish and large marine animals, are eaten by man; they provide him with only 2 per cent of his food energy.

Not all sectors of the ocean, which occupies 71 per cent of the Earth's surface, are equally productive. From the aspect of commercial fishing, the fish resources yielding a profitable catch, are concentrated in about 20 per cent of the ocean. The most valuable waters in this respect are the northern ones where the broad areas of the continental shelf combine a rich oxygen content in the water and the latter's active vertical circulation. Around 65 per cent of the world catch is made in the temperate zone (from 7 per cent of the ocean area), and 15 per cent in the tropics. The Antarctic waters are used primarily for whaling and very little for fishing.

The possibilities of exploiting the resources of the sea more intensively are associated not only with opening up new fisheries but also with introducing methods of deep fishing. At present the overwhelming part of the catch comes from depths less than 200 metres.

The resources of the ocean, though great, are not unlimited, it must be remembered. Rapacious exploitation of one and the same population of marine animals can lead to overfishing. With overfishing a population loses its capacity to reproduce, deteriorates, and may be completely wiped out. That is the situation that has developed off the coasts of North America with halibut, herrings,

and Pacific sardines. The herds of whales in northern waters are close to practical extinction, and whaling has shifted to Antarctic waters. As a result of increased killing the number of whales in that region has been so reduced that many countries already do not catch the quota assigned to them under special international agreements.

The resources of the ocean, which should become an important source of food in the future, need wise and rational exploitation and real conservation. But some of them are already threatened through pollution by oil and radioactive wastes.

At the level of science and technique at present achieved in the advanced countries, the productivity of the biosphere could now be considerably raised. There are many estimates indicating that our planet is capable of feeding an incomparably greater population than that which will be inhabiting it at the beginning of the twenty-first century.

It would be a profound error, however, to think that the problem of providing a normal diet in the "hunger belt" can be resolved by measures like a policy of birth control (as is being done in several countries, including India) or solely by scientific and technical means. The problem of hunger is engendered by a complex of causes, economic, social, demographic, historical, and natural, a complex that governs the economic and social backwardness of these countries. Attempts to resolve it solely by scientific and technical means can have the reverse effect, i.e., can aggravate already acute problems. A consequence of introducing high-yield crops, for example, can be accelerated class differentiation in the village (as has already been seen in the Indian and Pakistani Punjab), and an exodus of the mass of impoverished peasants to the towns. With weak development of urban industry that can lead to a steep increase of the millions-strong army of unemployed. Hunger caused by lack of food can give way to hunger caused by lack of purchasing power.

The principal condition for successfully tackling the food problem is to carry out a system of radical changes embracing all the most important aspects of the life of developing countries. In this respect those countries that have firmly taken the path of non-capitalist develop-

ment and are boldly advancing to the implementation of far-reaching reforms and to strengthening of the position of the state sector, the planned basis, and collective forms, have great chances of quickly resolving the problem of feeding their populations.

The elimination of hunger and malnutrition in developing countries is a great and difficult task. According to current estimates, to attain a per capita increase in consumption in them of 100 Cal. a day by the year 2000, and of ten grams of animal protein will necessitate a 293-per cent increase in farm production (including a 485-per cent increase in animal husbandry). To reach such growth rates, even if backed up by the necessary social changes and capital investment, will be a colossal task.

Chapter 5

LAND RESOURCES

V. V. Pokshishevsky, D. Sc. (Geog.)

It is useful, in present conditions, to make an objective and rational evaluation of humanity's actual land resources for settlement. In surveying this matter the author is sensible that figures on the areas suitable in varying degree for settlement, arrived at for whole continents, or for their geographical zones, do not signify a sufficiency or a lack of land resources in more detailed regions; there can always be quantitative disparities in the latter between these resources and the need for them. But in our view global calculations retain a certain significance, at least for a more critical approach to the fears now commonly expressed in bourgeois literature on general exhaustion of the Earth's capacity for settlement.

In order to get an approximate idea of the proportion of land needed for settlement in the total of land resources, let us cite a few facts.

The area occupied by cities is now measured, for the whole world, by a figure of around 500,000 square kilometres (or 0.3 per cent of the total land area). If we add to that the land needs of rural settlement, we get a figure that is probably four to six times larger. The plausibility of that ratio can be judged from data on the USSR. The area of the Soviet Union occupied by villages and other rural settlements is fourteen to fifteen million hectares, including seven million hectares of gardens, allotments, and small holdings. If we take it that the average density

of urban population is roughly 60 to 70 persons per hectare, the total area of the cities of the USSR is two million hectares, i.e., the ratio between urban and rural settlement is around 1:7 (including smallholdings in the rural estimate), or 1:4 excluding rural smallholdings. The total area of urban and rural settlement in the USSR, in spite of its being a country with a relatively extensive land area, and in spite of the average density of its population being less than half that for the inhabited continents, is for all that nearly 1 per cent of the total. Let us also add to that the area of land occupied by roads (the figure in the statistics of land use for most countries is practically unknown). It has been estimated (from data already very much out-of-date) that the area occupied by roads of all kinds, including cattle lanes, in the USSR is eight million hectares, i.e., about as much as the area of rural settlements without smallholdings[1]; the area occupied by roads has now, of course, risen considerably. In the early 1960s the total area occupied by structures, roads, industrial installations, and mine workings in the USSR was 38,100,000 hectares (equal to 1.7 per cent of the total area).[2]

In the United States the area alone of towns that had a population of 25,000 or more at the 1950 census was (by the data of that census) nearly 10,000 square miles (or 25,900 square kilometres), or around 0.3 per cent of the whole territory of the country.[3] This area may seem insignificant, but (1) it refers only to medium-sized and large towns, and (2) it is the average for the whole country. In the separate parts of the USA the area of urban building ("urbanised area") often occupies a larger part of the land area.

The American geographer Chauncy D. Harris estimated that urban areas (with a population of about 70 million

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[1] See *Yestestvennoistoricheskoye raionirovaniye SSSR* (Natural-Historical Regionalisation of the USSR), Vol. I, Moscow and Leningrad, 1947.

[2] See K. V. Zvorykin and P. N. Lebedev. Land Resources of the USSR and Their Economic Utilisation. *Itogi nauki. Geografiya SSSR*, Moscow, 1965, 1.

[3] Taken from summarised data on urban areas in *Statistical Abstract Supplement. Country and City Data Book, 1956*, Washington, 1957.

people in 1950) "occupied an area of 12,733 square miles ... or less than one-half of 1 per cent of the land surface of the United States. If the entire population ... were clustered in such urban agglomerations at comparable densities, the total land requirement for residential, industrial, and similar land uses would be less than 30,000 square miles, or under 1 per cent of the land surface of the country."[1]

At present urban types of land use are beginning to compete with farm use in the United States. American experts estimate that "in the period 1910-50, 40,000,000 acres in the United States were absorbed by towns, cities, and urban industrial developments ... and there is little reason to believe that this rate of 1,000,000 acres per year needed for such purposes will decrease appreciably in the immediate future. A single modern airport requires 5,000 acres or more".[2] It was estimated in 1965 that 3 per cent of the land suitable for farming was occupied by buildings in the preceding 15 years.[3] The forecasts for the future made by various authors speak of trends to continue the "greedy swallowing up" of land by populated centres. Thus the Greek writer on urbanism C. A. Doxiadis estimates that populated places will occupy 30 per cent of the land suitable for settlement in the world within 150 years.[4] S. G. Strumilin estimated in 1967 that the area of urban and industrial building in the USSR had quadrupled in the Soviet period, and would double again by 1980, and by 2000 would cover around 10 per cent of the whole area of the USSR.

These fragmentary figures indicate that the whole problem of providing land for the world's population is much more complicated than the usual disputes about whether or not there is enough land simply as a source for obtaining food.

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[1] Chauncy D. Harris. The Pressure of Residential-Industrial Land Use. In: *Man's Role in Changing the Face of the Earth*, Chicago, 1956, p. 889.

[2] Edward H. Graham. The Re-creative Power of Plant Communities. In: *Man's Role in Changing the Face of the Earth*, p. 684.

[3] See B. T. Urlanis (Ed.). *Naseleniye mira* (World Population), Moscow, 1965, p. 111.

[4] C. A. Doxiadis. Papaioanuva I. The City of the Future, *Ekistics*, 1965, 20, 116.

A scientific analysis of the whole aggregate of the resources that people need indicates that the "minimum" often proves not to be land as a source of food but, for example, water resources; a lack of water can begin to slow down economic growth.

Land as space for settlement also comes under resources of this type to a certain extent, the more so that social development as a whole (in spite of the fact that there is often an increasing trend toward multi-storey, high-rise building in cities) is leading to the development of many types of quite lavish "land expenditure" (airports; fast highways, especially with complicated multi-level flyovers; industrial undertakings with large grounds; various kinds of sport facilities and recreation areas; closed protection and conservancy zones of all kinds; national parks; and preserves. Approximate estimates, leaving out of account land used agriculturally, are that average land "expenditure" per million inhabitants is now probably 50 to 100 per cent higher than in the nineteenth century.

Quantitative estimates of areas with essential qualitative differences as regards possibilities of settlement are very inadequate. The land statistics of most countries largely pay attention to its agricultural uses; other forms of economic land use, including many whose role in social life is growing all the time, are often unwarrantedly grouped together (land covered by urban and industrial buildings, roads, etc.; the heading also often includes inaccessible land, and sometimes even the area of inland waters). Only a quite approximate actual (up-to-date) picture of land use for settlement as a whole can therefore be drawn, with many reservations.

Estimates of the area of land that can be potentially used for mass settlement in the future (either in "general" or in reference to a concrete date like 2000 A.D.) must, of course, be even more conditional, both for the Earth as a whole and for separate countries and regions. In fact, the figures concerned can only be reliable to some extent for those sectors of the world land surface that have been included in detailed, large-scale land registers. And even then a full answer cannot always be obtained since the appraisal usually only takes the agricultural value of the land into account and not its suitability for settlement.

Our own attempt to make a large-scale qualitative global estimate (or rather appraisal) of the land of the world yielded the results shown in Table 26.

Table 26

Land Area of the World by Suitability for Settlement
(millions of square kilometres)

Category of land by suitability for settlement	Total	Zone			
		Polar and subpolar	Temperate	Subtropical	Tropics, equatorial, and subequatorial
I	64.4	—	21.2	9.2	34.0
II	37.5	—	8.3	8.0	21.2
III	6.4	1.4	3.3	—	1.7
IV	40.7	26.7	5.5	2.0	6.5
Total:	149.0	28.1	38.3	19.2	63.4

As regards quality, it proved useful to distinguish the following four "main" categories of land:

(I) that suitable for mass settlement without special engineering measures or land improvements other than the ordinary ones, and not requiring special measures to acclimatise the population;

(II) that suitable for mass settlement but involving considerable engineering and ameliorative work (but not requiring special measures to acclimatise the population);

(III) land as in (II) but characterised by physiologically rigorous conditions even when the appropriate engineering works have been carried out;

(IV) that unsuitable for mass settlement.

Our estimates are made in millions of square kilometres accurate within 100,000 square kilometres. Greater accuracy is hardly possible in view of the state of the basic data.

These estimates indicate that category I comprises approximately 43 per cent of the dry land, and category IV (quite unsuitable for settlement) 27 per cent. Intermediate lands (categories II and III) occupy the remaining 30 per cent (category III comprises only a little more than 4 per cent).

The absolute area of category I land (and of the others) must in fact be less than shown because of the area of inland waters. An exact estimate of the area covered by water is very difficult to make; one can only consider it in any way reliable (on a planetary scale) for large lakes, especially those with comparatively stable shorelines. In the aggregate lakes cover 2,700,000 square kilometres (1.8 per cent of the Earth's land surface); all the waters of the land taken together probably reduce its area by at least five million square kilometres. One would expect them to reduce the area of category I land to 62 or 63 million square kilometres, and of category II land to 35 or 36 million square kilometres.

For the USSR, which has been well studied geographically, there is the basis for a rather more developed picture of possible land use for settlement.

The total area of the USSR is 22,402,200 square kilometres, of which 500,000 square kilometres are covered by outlying and inland waters.

Category IV lands comprise the Arctic islands and the Arctic coastline of the Asiatic part of the country north of latitudes 66° to 67°; in more southerly latitudes this category must also include high mountain areas. The absolute area of the Arctic islands is around 200,000 square kilometres. The Arctic coastal lands in the latitudes named (in the Yamal-Gydansky, Taimyr-Khatanga, Yana-Indigirka and Chukotka natural-historical provinces) total 1,600,000 square kilometres[1]; and mountain areas unsuitable for settlement (on the supposition that they constitute 5 per cent of the "net" land area of the USSR) can be estimated at approximately 1,100,000 square kilometres. The total land area in category IV must be around 2,900,000 square kilometres, including 1,800,000 square kilometres in Arctic and Subarctic regions, which constitutes 13 per cent of the total area of the USSR. The whole area of category IV must be excluded from estimates of possible mass settlement. When the need arises to found single settlements within this zone, they should not as a rule have permanent inhabitants. It is more appropriate to set up wintering stations in these places, or to use labour

[1] Here, and hereafter, we use the names of provinces given in *Yestestvennoistoricheskoye raionirovaniye SSSR* (Natural-Historical Regionalisation of the USSR), Moscow and Leningrad, 1947.

on a "shift" basis for separate production facilities associated with unique natural resources.

Category III can be considered to comprise the following territories: the Kola Peninsula and the Kanin-Bolshaya Zemlya and Pechora natural provinces in the European part of the USSR; the Mountain Tundra province of the Urals; the Ob-Yenisei province; the Lena-Khatanga province (plus the Lower Tunguska basin and part of the basin of the Podkamennaya Tunguska); the Kolyma province; the Koryak National Area; and the Yakutia and Aldan-Upper Zeya provinces. Their total area is around 3,930,000 square kilometres; and with the addition of certain other territories (e.g., in the Pamirs and elsewhere) around four million square kilometres, or 18 per cent of the area of the USSR.

The land in category II falls into two parts according to the character of the amelioration needed: (a) waterlogged lands suffering from difficulties of flow (the Vasyuganye, Polesye, etc.); (b) arid regions where irrigation is decisive for their economic development. The area of the first type is estimated at 2,500,000 square kilometres (including half of the West Siberian province, around the same amount of land in the boggiest parts of the Polesye, and separate sectors in Arkhangelsk Region, Karelia, and the Baltic republics). As for the arid regions, deserts and semi-deserts, they can be taken to include simply almost all Turkmenia, Uzbekistan (less its mountain areas), Western Kazakhstan, parts of Central and Southern Kazakhstan, the arid areas of Azerbaijan and Armenia, less the areas already in fact irrigated.[1] Approximate estimates of these arid regions give a total of 2,400,000 square kilometres (allowing for irrigated land about 2,300,000 square kilometres). Thus the total area of category II land is around 4,800,000 square kilometres, or about 22 per cent of the area of the USSR.

Category I land constitutes 10,200,000 square kilometres that can be considered suitable for mass settlement with no special limiting conditions (47 per cent of the area of the USSR).

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[1] Land with irrigation systems came to a little more than 11 million hectares in 1970 (or around 100,000 square kilometres). By 1973 their area had been raised to 12,700,000 hectares.

The USSR's land reserves for settlement are great, but are ultimately limited. Their limited character can be considered absolute, on the one hand, as determined by the area of land, and relative, on the other hand, because, with scientific and technical progress, the opportunities and the need to open up new territory will grow. These principles, in our view, can also be applied to all other countries, and to the Earth as a whole.

Marxist-Leninist theory is concerned with studying not only the immediate future of the development of humanity's productive forces but also, naturally, its remote future, since the distant future, too, belongs to communism. The progress of science and technology under socialism will enable the wealth and forces of nature to be used more effectively in the interests of the people, will discover new forms of energy and create new materials, and will develop methods of affecting climatic conditions.

Chapter 6

THE OUTLOOK FOR THE GROWTH OF WORLD POPULATION

A. Y. Boyarsky, D. Sc. (Econ.)

Fundamental problems of principle in the theory of population are often linked with the problem of the increase in world population in the next decades; but in fact they lie in the plane of the sociology of the present rather than in the "purely demographic plane", or the plane of the arithmetic of the future.

That does not mean, of course, that forecasting the population for the coming decades is not of exceptional importance for tackling a number of practical problems, including those of demographic policy, and for drafting long-term plans of economic development.

All practical problems must of course be tackled (and are) on a national scale on the basis of a forecast for each given country; but the background for the forecast is an estimate of the prospects for world population growth, especially for countries where external migration is of real importance.

During the first two-thirds of the last century population grew rapidly in Europe and, especially, in the USA. Malthus' thesis on a 25-year period of doubling of population might then have seemed convincing. But it would have meant population increasing 256 times over in two centuries!

At the end of the nineteenth century population growth had clearly begun to slow down in various countries, and that soon found reflection in radical changes in views on

the very character of its patterns. In place of Malthus' unrestricted geometric progression came Pearl's logistic curve.

Population growth continued to slow down in the twentieth century; and in the tables of natural increase in several countries there began to appear years when it was negative. Jacques Bertillon and many others sounded the alarm—depopulation was threatening—which subsequently became extremely more urgent, especially in the 1930s. This was soon reflected in forecasts; and the years and figures of maximum population were "precisely established" for several countries, the turning point being predicted for the then not very distant future.

Thus forecasts have gone through three successive stages. Predictions of unrestricted growth with doubling every 25 years were not justified. And no stop of growth at a certain limit, with population becoming stationary, was observable either. Nor was a transition from growth to decline observed. Hence it is clear that all these forecasts were not in fact forecasts, but only a kind of reflection of actual situations that followed one after the other.

Consequently it will not be an exaggeration to say that the whole experience of remote forecasts was at bottom one of failure. Nevertheless, more and more new attempts have been made to forecast world population, mainly at the beginning of the third millennium. The top limit of hypotheses of world population in the year 2000 is 7,500 million. It is based on present-day fertility being maintained with some decline in mortality. But since such a combination is hardly possible it will be more correct to take 7,000 million as such an upper limit. The lower limit, can be put at 5,000 million. The range is quite wide and there is little doubt that the truth lies somewhere midway between them. The essential question, however, is which limit is the truer. To some extent, and in some countries, the forecasting of population has features of those forecasts which are the better, the less they correspond to later reality. In any case that is the stand of those who stress the "threat" from population growth to the prosperity of nations and the world. The adherents of this trend therefore do not think it necessary to correct "unrestricted" estimates of future growth, con-

sidering that the less they correct it in their estimates the sooner and the more vigorously will it be corrected in practical demographic policy.

In recent official UN publications an estimate of 6,500 million has been given for world population in 2000. Not long ago we made a forecast with a "fork", the upper line of which was 5,500 million.

The upper limit of the period of real estimates of future population, after which they begin to be guesses rather than calculations, can be taken as 20 years. After 20 years those being born begin to be predominantly those whose parents have only just now to be born. The size of the working population is also more accurately determined within the limits of the next 20 years than outside them. Before the end of 20 years the working fraction of the population consists mainly of persons already living in the present population, and whose numbers can only be altered through the effect of mortality.

In contrast to forward calculations for 15 or 20 years, for which very exact mathematical methods and computers are suitable, the strength and precision of "exact" methods in attempts to forecast more remote periods, in particular to the year 2000, prove to be much too great in comparison with the roughness and doubtfulness of the initial premises. In addition, precise mathematical methods of computation may rather veil the vagueness of the initial data and the doubtfulness of the hypotheses underlying them. Other methods would be more suitable. It is much more important here to determine the most general methodological principles; and the most important of them is that of the socio-economic dependence of demographic processes. Thus the significant changes in the natural movement of population that often figure in the literature as the "demographic revolution of the 20th century" cannot in any way be explained by changes in the biological nature of man. The biological limits have never been attained as regards either births or expectation of life. It is also quite impossible not to see the socio-economic causes of the "demographic explosion" of the second half of the twentieth century.

Even when grouping countries formally by rates of natural population movement, we must note, groups are inevitably obtained ultimately that differ in socio-eco-

nomic conditions. If we start from this principle, then countries should be grouped first of all according to their social structure.

Thus the socio-economic approach requires, above all, that the world be divided into big groups of countries that are similar in this respect. Formal grouping by continents in this case does not work; there are countries at similar stages of development on the different continents; and on one and the same continent there are countries with very different socio-economic structures. At the Belgrade World Conference of 1965 we therefore proposed the following grouping, which allows not only for the social structure of countries but also for their degree of development and special features: I. the USSR; II. the European socialist countries; III. the socialist countries of Asia; IV. the capitalist countries of Europe; V. the USA and Canada; VI. Japan; VII. the Arab East, Turkey, Iran, and Afghanistan; VIII. India; IX. the rest of Asia; X. the rest of Africa; XI. the rest of the Americas; XII. Australia and Oceania.

In countries of groups I, II, and IV the average expectation of life has reached about 70. In those where it is 70 reserves for a rapid rise are almost exhausted, and its rise has slowed down significantly. In recent years the rise has slowed down or has stopped altogether, and here and there a tendency has even been noted for it to fall—a fact that cannot better stress the importance of struggling to improve the ecology and to combat accidents and other causes of death. Allowing for all that, we may hazard that, in capitalist countries (of these groups), the average expectancy of life at the end of the century will be around 80.

Another hypothesis has to be adopted for the European socialist countries. In them there is quite a different socio-economic system, and that has far-reaching consequences for all the factors affecting mortality. In addition to the general trends in the developing of the economy and prosperity, it is sufficient to note the quite different principles (compared with the capitalist West) in the organisation of the health service and the scale of medical care itself, and the high development rates in education. The struggle to improve environmental conditions in these countries is being waged with greater in-

tensity and effect, all of which cannot help ultimately having its effect. One may suggest that the expectation of life will rise to 85.

The coming decades will be a period of very great changes in the socio-economic structure of the countries in which the greater part of the world's population lives. Changes in world population in this period will therefore be conditioned not so much by reproduction regimes as by the process of transition from one regime to another. This makes study of transitional regimes and of the consequences brought about by the transition itself extremely interesting. In particular, the age structure of Europe's population had already for some time been reflecting features not so much of an existing regime or of the former one as in fact the consequences of the transition from the old regime to a modern one.

The significance of that for our task will be readily understood. According to certain propositions of mathematical population theory, the size of a stationary population equals the product of the number of births and the average expectation of life. Given a stationary state of population (and an identical number of births) a population should consequently be proportional to the average expectation of life.

Parallel with the growth of population that has occurred in the last century, we may note, there has been a decline in the birth rate in Europe and a certain, very relative of course, stability in the absolute numbers of births. In Italy, for example, the yearly number of births has remained at a level around one million for almost a century; in 1966 it was still 980,000, and only in 1970 did it fall to 900,000. In all group IV countries the yearly number of births at the beginning of the 1840s was 5,400,000; on the eve of the Great Depression in 1928 it was also 5,400,000, in 1960 5,800,000, and in 1970 again 5,400,000 (with variations in between, of course).

If we take it that births remain constant for quite a long time, and ignore migration, the problem of the size of a population becomes simple and boils down to the expectation of life. That does not mean, however, that a population can be represented, as in the theory of a "stationary population", as the product of the number of births and the average expectation of life. For the latter reflects

only the age levels of the mortality existing now; and for a simple application of the formula of a "stationary population" it is necessary for the corresponding "order of extinction" to be preserved for nearly a century.

For forty-year-olds living now the transition from birth to ten was completed in conditions of the "order of extinction" that existed 30 or 40 years ago, and the transition from 30 to 40 in conditions close to current ones. The transition from ten to twenty, and from twenty to thirty, occurred in conditions of intermediate "orders of extinction". On the whole the actual change in their numbers as they die out will trace the curve described by a point gradually passing from the line of one "order of extinction" to that of the other. The numbers of age groups (given a constant number of births) will therefore trace out such a transitional curve.[1] The total population will reflect the proportional mean of two average expectations of life separated by an interval of about 80 years.

In that case population should have altered over the 40 years 1920-60 by the following ratio:

$$(e_0^{1960} + e_0^{1880}) : (e_0^{1920} + e_0^{1840}),$$

where e_0 is the average expectation of life at the given time.

The appropriate calculations made for several countries on the basis of the mortality tables for periods close to these dates indicated that the population should have altered as follows in 1920-60, according to this rule (only differing markedly from what actually happened for Holland) (see Table 27).

Not having the relevant statistics at our disposal for several groups of developing countries, we have deemed it feasible to adopt an initial $e_0^{1880} = 25$ and a final $e_0^{2000} = 60$. Then four types of transition can be noted, as follows:

[1] More exactly, if $\mu(x, t)$ is the death rate at age x at time t, with a constant number of births N the numbers of age x at time t will be $N exp - \int_0^x \mu(z, t-z)\,dz$. If μ diminishes, then $\mu(z, t-x) > \mu(z, t-z^0) > \mu(z, t)$.

The inequality will hold also after integrating according to dz within the given limits; hence it follows that the numbers of age x at time t will lie on some middle line of extinction.

(1) uniform, with an increase of approximately one-third in every 40 years, i.e., $e_0^{1920} \cong 33$; $e_0^{1960} \cong 45$; ($K =$ $= 1.33$);

(2) slow: $e_0^{1920} \cong 40$; $e_0^{1960} \cong 52$; ($K = 1.3$);

(3) accelerated: $e_0^{1920} \cong 30$; $e_0^{1960} \cong 40$; ($K = 1.4$);

(4) very fast: $e_0^{1920} \cong e_0^{1880}$; $e_0^{1960} \cong 35$; ($K = 1.42$).

Table 27

Changes in Selected Populations of Western Europe

Country	Actual population (million)			Calculated coefficient
	1920	1960	Coefficient of change	
England and Wales	38	46	1.2	1.2
France	39	46	1.2	1.2
Sweden	6	7.5	1.2	1.2
Holland	6.8	11.5	1.3	1.7
Italy	37	48	1.3	1.3
Belgium	7.4	8.5	1.1	1.1

It will be seen that the coefficient K does not vary strongly in spite of the various types. For groups I, II, IV, V, and VI, taking $e_0^{1880} = 40$, it can be calculated more or less directly. Multiplying the initial population by K we obtain the "conditional stationary population". The sum total proves to be slightly over 4,000 million.

There remains the most difficult and the easiest hypothesis, that of the numbers of births or natality. It is the most difficult because of the lack of adequate grounds for a clear forecast; and it is the easiest because of the chance, for that very reason, of adopting any hypothesis.

The most important factors altering the birth rate, in our opinion, are socio-economic. What is more, we do not think that natality can be lowered by the growth of well-being in itself. There are no sufficiently weighty indices of the existence of such a direct connection; and there are often parallel tendencies having quite other sources. Sharp variations of prosperity, in considering which it is mainly taken that the other factors remain unaltered for short intervals of time, prove rather to have a direct connection with the birth rate (decline in years of crop failure, crises, etc.).

The socio-economic factors that have a particularly significant effect are ones like the use of working hands in the household; its fate at division of the inheritance; the drawing of women into work outside the home associated with a decline in the proportion of the agricultural population and with the structure of agriculture itself; the ratio of the level of needs and their satisfaction; and cultural, psychological, and other factors.

In the developed European capitalist countries, for the 14 years 1954-68 only, the proportion of those working in agriculture fell (in France from 28 to 16 per cent; in Italy from 40 to 21 per cent). The coincidence of the increase in population and of the coefficient K shown above for six European countries, however, is rather deceptive; one must not ignore emigration and the two devastating wars that greatly affected population growth in those countries.

All this means that adjustments of one kind or another must be made to the "conditional stationary population". While we are not yet in a position to exactly determine the optimum population reproduction regime in the USSR, we can in any case count on measures being taken in the next few years that will alter this trend. As the population grows that should lead all the more to an increase in the number of births; but to try and take the effect of as yet unknown changes in the sphere of demographic policy into account in forecasts is too precarious a path. We would hardly be wrong, however, in saying that rapid population growth is not to be expected in the coming years in spite of the fact that the composition of the age group most significant for natality will no longer include the relatively small contingents born in the war years, and that the traces of war losses will be shifted to age group of less general weight in the population. Considering all that we may suppose that the population of the USSR will be slightly higher than the "conditional stationary" one. If we take the increase at 5 per cent, that would mean that the Soviet population would grow by a ratio 1.05 (85:70) = 1.27. Multiplying that by 242,000,000 (1970) we get a 2000 A.D. population for the USSR of 308,000,000. If we take 250,000,000 (August 1973) as our starting point, and the rate of increase existing then, (0.9 per cent), we get about the same.

Relatively low average natality is now characteristic of the European socialist countries, with a tendency to fall. This tendency will perhaps decrease in the future. Moreover, one must bear in mind that the population in these countries had sustained serious losses during the war, and that will affect its age structure in the same direction as in the USSR. Taking all these considerations into account one may assume markedly greater numbers for these countries as compared with the "conditional stationary population".

As for group III countries one may expect that decline in natality will relatively be not less than population growth. That means that one can adopt the hypothesis of approximate stability of the absolute number of births, i.e., start from a position close to that which existed in Europe after the middle of the nineteenth century. For group III therefore we may limit ourselves to a smaller increment to the "conditional stationary population".

In group IV countries natality has risen by comparison with pre-war, and there has been a marked rise in the absolute numbers of births. The proportion of the agricultural population is already quite small and the elimination of petty owners that is still going on is reducing the proportion in general of people who are especially interested in limiting the number of heirs. The population of those countries, except the Federal Republic of Germany, did not suffer so heavily in the war years, so that one can take an appreciably larger population in them than the "conditional stationary" one.

The same applies to group V and XII countries, in which the United States has the greater part of the population.

In group VI (Japan) one must expect the smallness of the recent contingents of births to produce a new wave of falling numbers of births in the 1970s and 1980s. There is also to be a decline in the proportion of the agricultural population. In view of all those circumstances no addition can be made to the "conditional stationary population".

In group VII-XI countries development toward industrialisation is not proceeding so rapidly. The initial birth rates are very high and there are deeply rooted tendencies

opposing a fall. Their populations will therefore probably be much greater (by 20 per cent or more) than the "conditional stationary population".

Thus the sum total is expressed by a figure around 5,000 million. But it is considered normal to accept an error of 1 per cent in censuses; what then is to be expected in a forecast for three decades? Would we not be quite justified in taking the error at 15 or even 20 per cent? If we take it as 15 per cent, that would mean a range of population between 4,300 and 5,600 million; and taking the margin of error for the USSR at half that, i.e., ± 7 per cent, we would get 308 ± 22 million, or between 286 and 330 million. But the gap to the lower limit is so small that there is little doubt that it will be exceeded. Consequently one may formulate the general conclusion as follows: by 2000 the world's population will in any case considerably exceed 5,000 million; and allowing for the facts of recent years, it is more likely to be nearer 6,000 million, which differs little from the latest UN forecast.

The estimates of economists, agronomists, biochemists, and other specialists indicate that the world is quite capable of feeding such a population and even one several times larger; but that would naturally necessitate its being able to use its resources properly.

Section Five

CURRENT POPULATION PROBLEMS

Chapter 1

DEMOGRAPHIC INVESTMENTS

A. Y. Kvasha, Cand. Sc. (Econ.)

A truly scientific treatment of the problems of economic demography in general and of the optimum correlations between population growth and development of the economy in particular is only possible on the basis of a Marxist-Leninist understanding of the laws of social development. And only given the planned character of the socialist economy can scientifically validated demographic policy measures aimed at achieving the optimum type of reproduction be carried out on a broad scale.

One of the most important problems of economic demography is to determine the volume of supplementary expenditure caused by one rate of population growth or another. The problem is not only of great importance for countries with high rates of population growth but also for those states and areas where the age and sex structure of the population is changing.

With the capitalist form of production "investments in the human factor" mask the essence of labour power as a commodity. From the general economic aspect demographic investments are the mode of movement of the population and of the national income caused by a change in the population's age structure. It is exceptionally important to analyse the forms in which this process manifests itself under socialism.

In the USSR, where there is great differentiation in the processes of reproduction, it is of great national economic

importance to determine future supplementary expenditure in connection with population growth.

Like the economy, population is not something stable. Its total numbers and age and sex structure change with time. Even if there were an invariable level of scientific advance, the change in total population alone would also alter the size of total and mean per capita expenditure on food, clothing, and other needs. And the means for them have to be provided for every new member of society.

The national income (in the absence of external receipts) is the sole source for expanding production, the reserve from which we draw the means to raise growth of labour productivity and increase national wealth. In other words, expenditure on extending production—one can call it economic investment (in the broad sense of the term)—is also derived from the national income.

In a population that is not changing in size or structure (e.g., a stationary population), given an unaltered standard of living, it is not necessary to allocate new supplementary means for these needs. A clear line can therefore only be drawn between economic and demographic investment in a population changing in composition and size, in which it is possible to distinguish quite clearly the group of people for whom extra capital investment is needed; the concept of demographic investment therefore has a rather theoretical character.

With rising technical standards in a stationary population, all investment is economic. With an unchanging technical level and a growing population all investment is demographic. If the population is growing in conditions of technical advance there may be both types of investment, and the line between them will be very arbitrary.

Let us look at the mechanism of the formation of demographic investment in the case of housing. In a stationary population it is necessary, in order to maintain the existing housing fund (taking the depreciation period at 100 years and one room per tenant), to build 1 per cent of new rooms every year. If the population is growing at an annual rate n, then it is necessary, simply so that housing conditions do not deteriorate, to build $1 + n$ new housing.

As for a population that is increasing rapidly in numbers, one must not just bear natural growth in mind. A population can also increase through migration. From the angle of volume of capital investment unforeseen migration (in time and scale) is analogous in many ways to a large natural increase in population.

The scale of migration, especially into leading capitalist countries, is often artificially limited. The living standard of immigrants is often held at a level below that of the inhabitants of the metropolis by a number of measures. External migration can therefore have a real effect on the size of demographic investment in the absence of limitations of any kind on the processes of migration and demand.

Population can not only grow, but in certain conditions (with contracted reproduction) it may decline year by year. In that case, with unaltered rates of scientific advance, the volume of expenditure on food, clothing, and new jobs may be less in absolute terms than before, i.e., the magnitude of demographic investment may be negative.

With time not only may the size of a population alter but also its age and sex structure. We know, moreover, that expenditure on maintaining people of different ages alters considerably in money terms with age (not to speak of its structure). Expenditure on education in the young age groups is much higher than for older groups, while expenditure on medical care is higher in childhood and for the older age groups of the population than for middle groups.

Marked changes in the age structure of a population (e.g., the arrival into, or departure from, a country, or some part of it, of a big group of young migrants) can therefore alter the size of demographic investment. In most cases, however, these changes take place comparatively slowly, so that it is not easy to single the "structural investments" out quantitatively. On the whole, by demographic investment one can understand expenditure necessary at least to maintain existing living standards for a population growing in size or changing its age and sex structure.

We shall essay to determine the scale of that part of demographic investment caused by changes in age

structure, employing the method proposed by Valkovics[1]. Taking the age structure of the total population of Hungary and of its active part as his starting point, plus the corresponding age scales of consumption and production and mean per capita value of total national income and also of that part of it going on consumption and accumulation, he was able to find the ratio of production and consumption for various age groups and for the population of the country as a whole. These calculations can be made for men and women separately.

Valkovics's method enables one to determine how a population's volume of consumption is changing, i.e., the portion of demographic investment that is going on food, clothing, and in part on housing and medical services, not only in connection with its total growth but also with changes in its age structure.

According to his calculations, Hungary's volume of production in 1959-60 (in 1959 prices) was 133,100 million forints, and consumption 103,700 million forints (the difference being 29,400 million forints). His estimate was that consumption for 1981 (at 1959-60 age norms and prices and for the 1981 age structure) would be 113,500 million forints or 9,800 million more than in 1959-60, mainly due to changes in age structure, since Hungary's population (on this forecast) would rise from 9,960,000 in 1960 to 10,730,000 in 1981 (an annual average growth of 0.35 per cent).

An important trend in economico-demographic research is study of the effect of population growth rates and of the economy's efficiency of operation on the growth rate of living standards, and the relation of economic and demographic investment. Models on this plane are broadly presented in the work of Léon Tabah.[2]

In a population increasing at rate n, economic investment is I_e, apart from demographic investment I_d; taken together they constitute total investment I_n.

If $I_n - I_d > 0$, then per capita production will rise; when $I_n - I_d < 0$, the standard of living will fall.

These correlations enable us to determine the scale of

[1] E. Valkovics. Production and Consumption Age Pyramids of Hungary's Population, *Démográfia*, 1966, 10, 3:317.

[2] Léon Tabah. *Démographie et aide au Tiers Monde I. Les modèles*, *Population*, Paris, 1968, 3:509-34.

demographic and economic investment (in money terms) approximately both to maintain existing living standards and to raise them, given definite population growth rates.

The total investment (economic and demographic as a percentage of the national income), given an annual rise in living standards of 4 per cent in accordance with the population's rates of reproduction and the ratio of annual growth of national income to total volume of investment, can vary between 13.4 and 27.5 per cent of the national income. According to Tabah's estimates, the proportion of demographic investment in the national income would vary between 3.9 and 7.8 per cent in these conditions, given a rapid fall in the birth rate to the 1951 level in England and a slow fall in mortality, and with a ratio of annual growth of national income to total volume of investment between 0.17 and 0.33.

Sauvy has estimated that with this ratio at 0.25 and an annual rate of population growth of 2.5 per cent, i.e., with a high (or very high) birth rate, and an average (or low) death rate, the standard of living will rise by 1.9 per cent per annum, if investment in that time is 15 per cent of the national income.

That, in itself, is already very high expenditure. Even if such rates of population growth and investment were possible, it would, however, take around 22 years to raise the mean per capita national income by 50 per cent. If allowance is made for the fact that per capita income in a number of newly independent countries is very low in absolute terms, such rates would hardly meet the aspirations of the peoples of developing countries to eliminate economic backwardness and improve their living standards within the shortest period possible.

To raise living standards by, say, 4 per cent per annum (at that rate it would be doubled in around 18 years) with a 2.7-per cent average annual growth of population, would, however, require 24 per cent of the national income (according to Sauvy) to be invested every year.

What would the ratio be between economic and demographic investment with various assumptions of the change in living standards, taking average annual population growth at 2.5 per cent and a ratio of investment to growth of national income at 25 per cent in both cases? To maintain existing living standards (according to Sauvy) 7.5 per cent

of the total national income would have to be spent on de mographic investment; with a mean annual increase of 2.0 per cent in living standards, 7.5 per cent of the national income would have to be spent on demographic investment and 8 per cent on economic investment.

The problem of the optimum scale of demographic investment can only be resolved by taking the content of the concept of the optimum type of reproduction as a whole as one's basis. The problem of a demographic optimum objectively exists for several reasons. The first is the limited character of society's resources, above all of manpower (which in practice is a given quantity for a period 15 to 20 years ahead). For its long-term plans, therefore, a socialist society must determine that variant of population development that is most acceptable from the aspect of efficient use of all resources.

A second reason is the existence of a single development goal in socialist society, which makes it possible to define criteria of the efficiency of socio-economic development, including demographic development.

It is very difficult to distinguish the criteria of the demographic optimum. The difficulties are due to the complexity and variety of the factors moulding one type of reproduction or another as the object of optimisation, and to the objectives of the various parts of the country on the demographic plane, which do not always coincide. At the same time these objectives are always elements of some general task. The general criteria of demographic optimum must therefore be considered a hierarchical system embracing problems of economics, social psychology, etc. Problems of the demographic optimum, or rather of the socio-demographic optimum, are also important because the goal of demographic policy is moulding of the optimum type of reproduction.

In political economy it is quite logically assumed that the value of durables is spread uniformly over a certain period of their use. In practice, however, the public requires a concrete durable in ready form, and often at a definite time, if its standard of living is not, of course, to be lowered. So, for example, a baby's layette is needed not in instalments but of a minimum size and composition at the time the child is born. If the population of a

country grows by a certain amount each year through natural increase, the country must annually produce an additional number of children's requisites and other finished goods.

The case of schools is even clearer in our view. When a population grows it is necessary, so as to maintain the level of education already attained, to open *n* new schools at the beginning of the school year; and if, for example, it takes two years to build a school, it is necessary for funds to be provided two years in advance so that the schools will be ready in time. And so on, each and every year. Although the school building will last much longer than it took to build, the money spent on it must be recovered fully in a definite period.

Thus expenditure on "demographic financing" is limited in time, but its utilisation is, so to speak, "stretched out" in time. Matters are the same in principle with new jobs for the rising population; they are needed at a definite date in ready form, and not in instalments.

These problems are particularly acute for developing countries where it is often not simply a matter of building schools for the "new" contingents of children, but also of similar expenditure (although on a lower per capita scale) for the whole child population and some of the adults. These features of demographic expenditure must be allowed for in analytical form when modelling the interconnections of economic and demographic processes.

The differences in level of "demographic expenditure" in the Soviet Union are one of the reasons (though not the main one) for the need to redistribute income among the Union republics. But whereas, in a socialist country, this gratuitous redistribution is based on the very essence of the system, it is quite otherwise in capitalist and developing countries. High population growth rates force developing countries to earmark a considerable part of their small (in absolute size) national income for demographic investment simply so as to maintain the living standards already attained.

This review of the problem of demographic investment cannot be taken as even a first approximation without examining yet another matter. The whole of the preceding analysis stems in essence from an assumption of the

rational use of demographic investment, especially of its saved part; but such a use, i.e., for the needs of society and in particular of the working people, can exist only in a progressive social system.

Under capitalism, especially in developed countries, this "demographic saving" is often spent on maintaining a growing repressive apparatus, on the arms race, and on various kinds of direct and indirect payment to privileged circles. In that case only the strength and action of the people and of their vanguard (Communist and Workers' Parties and progressive organisations) can force the ruling circles to switch part of these funds (within the limits, of course, imposed by capitalist relations) to raising the people's living standards.

Chapter 2

SOCIAL PRODUCTION—PERSONAL NEEDS—NATALITY

R. S. Rotova, Cand. Sc. (Econ.)

Social production—consumption and personal needs—rate of child-bearing are processes calling for all-round, integrated analysis. Their interaction is beyond doubt, and social production plays the leading role in it. The level of development of social production and the relations of production, which mainly operate indirectly through the level of consumption and people's economic needs, ultimately have a decisive effect on natality.

As social production develops an increasing part of man's needs requires objects of labour to meet them, or is met through the expenditure of labour. A considerable part of both material and cultural needs is in essence economic needs.

Attempts have been made to bring out the dependence of the number of children in a family on such conditions as income, character of housing, the involvement of mothers in social production, and certain other individual aspects of the socio-economic conditions that affect living standards. But their separate aspects have been considered in isolation from the other elements harmoniously linked with them, and only the influence of actual consumption has been analysed, without taking the level of needs into account. As a result, researchers examining one and the same problem (e.g., the effect of income on natality) came to diametrically opposite conclusions.

It is axiomatic with demographers today that industrialisation, urbanisation, educational standards, and

the employment of women in social production directly affect natality in the direction of lowering it. On the basis of quantitative characteristics lying on the surface of these phenomena (the growth of industrial production compared with agricultural; the increase in urban population; the proportion of working women among those of child-bearing age, and so on), attempts are made to explain the essence of the changes taking place in the dynamics of natality.

Industrialisation, urbanisation, the raising of educational standards, and the employment of women in social production operate as separate, interconnected manifestations of one and the same process of social advance, and above all of scientific and technical advance. They have a number of inherent features in common.

Industrialisation, as the development of large-scale industry on the basis of heavy industry, and especially of mechanical engineering, does not embrace different territories simultaneously, and consequently draws different groups of the population into the productive sphere.

The development of technology forces people constantly to improve their cultural and technical standards and their capacity to control mechanisms. That in turn influences change in the volume and structure of material and cultural needs. Simultaneously with that industrialisation is accompanied with an extension of the social division of labour, extension of the production of a greater and greater variety of goods and services for both productive and non-productive consumption. Large-scale machine industry provides a constantly expanding material basis stimulating the rise of more and more new types of consumption. As industrial development proceeds, an objectively governed phenomenon is the complication of and continuous change in the structure of consumption.

The raising of people's educational standards, like industrialisation, is simultaneously linked with rapid extension of their material and cultural needs. It is necessary to stress, at this point, in addition, that it takes more and more time to obtain and master the general, vocational, and scientific knowledge acquired by the preceding generation. There is therefore a steep rise in the need for non-working time, especially for leisure.

Urbanisation generally develops as the inevitable accompaniment of the deepening division of labour in society and of the growth of large-scale industrial production, and is accompanied as a rule with accelerated growth of the urban population, especially in large cities.

People living in the biggest cities, whether or not they are directly involved in modern industry themselves, or are linked with it through various service institutions, experience the effect of scientific and technical progress on themselves earlier than the population living in other places more remote from large-scale industry, especially in rural localities. They have the chance to make use of all contemporary achievements earlier, and of new types of goods and services for improving city and home life, and also to satisfy the new material and cultural needs that are being brought into being.

Urbanisation fosters more rapid growth of new wants. If we compare developed cities with rural settlements in the USSR, especially in the first period of acceleration of urbanisation, the housing and living conditions in the latter are behind those in cities as regards amenities and conveniences, the general standard of services, and so on, while the economic significance of the personal smallholding or allotment is much greater in rural localities than in cities. All living conditions, including both working conditions in social production and conditions outside productive activity, form a less complex and less modern structure of needs among the people of rural localities and less developed urban settlements, a structure that slightly lags behind that of the population of developed cities.

The employment of women in social production is the result, in the first place, of the growing cultural needs of women for specialised education. Growing material wants give rise to a need for ever larger financial provision for the family and foster ever greater involvement of women in social production. Their employment in turn once more affects the growth of material and cultural needs and the fullness to which they are satisfied. At the same time working women's non-working time for the satisfaction of material, and especially of cultural, needs is curtailed. A contradictory situation arises, in which female employment, while bringing in extra income for

the family, leads to more rapid growth of women's needs. yet at the same time reduces their non-working time, and especially their leisure, for satisfying those wants.

The effect of the growth of women's needs (and not of employment) on natality is seen most vividly in farming. In the Soviet Union the peasant woman, and later the collective-farm woman, was always directly involved in the process of agricultural production. But limitation of natality in rural families began only at a certain stage of the development of farming, when the volume of the country woman's needs grew rapidly and their structure altered. To a considerable extent child-bearing began to be limited in rural families independently of any change in the employment of women in production.

The spread of family birth control began later in rural localities, in our view, precisely because the rural population's material and cultural needs lagged behind the urban population's, which was due to the fact that the degree of industrialisation and technical equipping of farming was lower than in large-scale industry, so that scientific and technical advance called for faster raising of the educational and professional standards of industrial workers earlier and more pressingly than those of agricultural workers.

The employment of women in social production cannot, in our view, be considered the real cause of the change in natality. Employment itself is engendered by a growth of needs and in turn leads to a change in them.

Natality is not so much affected by industrialisation, urbanisation, raising of the educational and cultural standards of the population, and the employment of women in social production as by growth in the volume of people's needs, and the change in their structure, and by the degree to which those needs are met.

Wants begin to affect natality only when they reach a certain level of development, which creates a need for spread of family birth control. It is important therefore to elucidate the standard of popular requirements that faces families with a need consciously to limit child-bearing.

The developed character of material and cultural needs is determined by the level of industry in the broad sense, by the degree of man's domination over nature. In the

early stages of the rise and development of social production they were extremely undeveloped and amounted to physiological needs for the preservation and reproduction of life. "At the dawn of civilisation the productiveness acquired by labour is small, but so too are the wants which develop with and by the means of satisfying them."[1] Gradually needs came to include not what substantially and directly satisfies hunger or thirst biologically, and protects against bad weather and cold, but also what helps in the process of gaining one's daily bread, that is to say, for work, i.e., what extends people's knowledge and experience of intercourse in the productive and non-productive spheres of activity.

No new generation begins its life from scratch, but is already in possession of accumulated material wealth, tools and experience of using tools, knowledge of the world around and of the results achieved by each preceding generation, which operate as the objective conditions for the next one. There is a gradual transition from less developed productive forces in the broad sense to more developed ones, which also determines the ascending growth of people's wants. Marx noted this objective tendency; Lenin, as we know, called it the law of growing requirements.

Every new generation also inherits an achieved level of wants from the preceding one; and the material conditions in which the new generation begins its life enable it to satisfy these inherited wants at a standard no lower than that of the preceding generation (unless, of course, the general trend of the growth of needs has been interrupted by natural calamities or equivalent phenomena).

People's wants operate as historically developed phenomena during the whole course of man's history, that is to say, also before the beginning of industrialisation, urbanisation, and other such processes. But with the development of large-scale machine industry, replacing production based on hand work, their growth rates and structure are altered and also the urgency of meeting them.

Large-scale machine industry continually accelerates accumulation of material wealth, and of the implements of production and experience of using them, makes people's knowledge of the natural environment more and

[1] Karl Marx. *Capital*, Vol. I, p. 479.

more complex, and increases the frequency with which some needs are replaced by others, more modern and corresponding more to the latest achievements of social production, science, and culture.

That also creates qualitatively new conditions for the reproduction of labour power, which consists (1) in meeting the accumulated material and cultural needs of the workers at that stage, and (2) in restoring the physical and intellectual strength expended in the labour process and in developing the capacity for labour further, for which the workers require additional means of subsistence.

The qualitatively new level of needs and the rates at which they are growing, which present the population with a need for family birth control, are linked with the transition to large-scale machine industry.

Needs may also affect the birth rate in the absence of some of the conditions enumerated above (in non-urbanised areas, with unaltered employment of country women). But industrialisation, urbanisation, the growth of education, and the employment of women in social production manifest themselves on the surface as the actual causes of the change in natality, (1) because they are inevitably accompanied with an extension of needs, although the growth and change of needs is not necessarily linked with them; and (2) because the volume and structure of material wants, and especially of cultural needs, still have no adequately accurate quantitative measure, while industrialisation, the growth of urban population, the employment of women, and educational standards have long been quantified quite accurately, which enables us to trace their effect, or rather through them the effect of the level of wants, on the birth rate.

This conclusion is confirmed by data on changes in the birth rate in conditions in which family birth control is common in economically advanced capitalist and socialist countries, where, in spite of the further development of industrialisation, urbanisation, etc., a rise in natality has been observed in some periods (the well-known data on the rise in the birth rate in, for example, the United States, France, Canada, and certain other countries).

In other words, these factors seem to cease to exert a lowering influence on natality in a whole number of

cases, which is the result, we are convinced, of a manifestation of the effect precisely of changes in people's needs on natality. To put it differently, the concrete birth rate is determined, given the spread of family birth control, both by the standard of needs achieved and by the ratio of needs to actual consumption. That makes it possible (a) to clarify the framework within which it is permissible to use quantitative indices of the development of industrialisation, urbanisation, etc., as conditions affecting natality (these conditions may serve as definite, though far from exact criteria only for investigating the beginning of society's transition to accelerated spread of family planning); (b) to substantiate more comprehensively a demographic policy affecting the birth rate in the direction required by society.

Analysis of natality in connection with the dynamics of needs (in the general interconnection of production and consumption, of needs and natality) can help a little to explain areal differences in concrete birth rates. The most important thing here is to determine at what level and at what degree of satisfaction of needs, given widespread family planning, there is a higher birth rate in some areas and a lower one in others.

The ratio of the levels and rates of economic development of the different branches of social production is the basis for correlating the levels of economic development of different areas. Those industries alter and improve fastest that ensure technical equipping of the economy (e.g., today, mechanical engineering, machine tools, instrument-making, rocket engineering, radio engineering, power engineering, chemicals, etc.). The areas in which these industries are concentrated correspondingly develop the fastest.

The faster these industries develop, the higher is the level of consumption and the faster the needs of the population groups associated with them develop.

The ratio of the levels of production in different areas is the basis for differences in the population's standards of consumption and wants. And through consumption and needs the industry of the given areas, and of society as a whole, determines the differentiation in the rate of child-bearing in those areas.

As social production grows there is a levelling up of

the consumption and needs of the population of different areas, due to an increase in the various links, primarily economic ties, between them, and to the effect of the most economically developed areas on speeding up the development rates of the others.

An important point in studying the links between needs and the birth rate is understanding of needs as a complex system of interconnected elements requiring a certain degree of harmony in their development. The complexity of the structure of needs is determined by the level of development of the productive forces. As demographers' research has until recently been based on sectional study of the different elements of actually satisfied needs, and of the total structure of wants, correct understanding of the way the individual types of need are tied in together is of no little importance for a more all-round substantiation of conclusions about the socio-economic conditionality of natality.

The approach to needs as a system, and knowledge of their patterns of development, make it possible not to accept the idea of a certain inertia in natality.

Conclusions about the inertia of a demographic process like natality are usually drawn from the results of the demographic policies of a number of countries aimed at encouraging natality. (Despite the payment of supplements to pay, or of children's allowances, improvement in the housing conditions of families with children, and the implementation of health measures, no significant tendencies for natality to increase have been observed.) Some researchers conclude that a certain length of time is needed for the reconstruction of the process, comparing the "lag" in changes in natality with the moment of the beginning of changes in the separate elements alone and not in the whole system of needs. They do not allow for the necessary pattern of adjustment inherent in the development of needs; the development of one need engenders a whole chain of others inseparably connected (conjugated) with it, both of the people and of society as a whole. Satisfaction of the needs for housing, for example, accelerates growth of needs for modern furniture, domestic machines and appliances, and other items of modern home life. A broad complex of measures to encourage natality entails a similar conjugation of needs associated with

additions to and reconstruction of the network of medical services, pre-school children's institutions, shopping facilities and services, and public utilities and amenities.

In implementing such a demographic policy not only are existing financial and other material resources redistributed among groups of the population in favour of those with the number of children in families wanted by society, but additional funds are allocated so that these families' needs will be satisfied at a level no lower than that prevailing in society. In that connection an increase (particularly a marked one) of the cash income of the population as a result of the payment of children's allowances calls for an extension of the production of consumer goods and services satisfying, as a rule, the new demands already formed or forming. And there is supplementary capital investment in the appropriate branches of light industry and in the branches of heavy industry associated with them.

A significant change in living conditions and an increase in the degree to which the needs of families with children are met, and the stimulating of a rise in natality necessitate the reconstruction of many branches of the economy.

The rate of this reconstruction entails a time lag before the effect of demographic policy can be expected.

The "inertia" of a demographic process like natality is due in a certain sense to the depth, scale, and rate of the changes in socio-economic conditions. It is not a question of the demographic process lagging behind the socio-economic conditions, but of the degree to which it depends on them. When family planning is not common, natality therefore either alters very slowly or remains practically unchanged till a certain level of development of needs determined by the appropriate socio-economic conditions. But given family planning natality responds sensitively to the actual changes, not so much in the separate elements, as in the whole system of needs, in which a change in one of the elements inevitably gives rise to quantitative and qualitative changes in the others.

The link between natality and socio-economic conditions, and its rapid response to changes in these conditions, can be seen most clearly, it would seem, when there is a sharp decline in the satisfaction of personal wants.

Such a deterioration results, as a rule, from natural calamities, crises, wars, and so on, and involves the whole system of needs. Clarification of the reaction of natality to a change in the system of people's needs in every historically determined period is, therefore, in our view, a most important methodological problem.

Knowledge of the patterns of development of the system of needs would enable demographers today to understand the socio-economic dependence of demographic phenomena better and to bring society close to the possibility of really controlling demographic processes.

Chapter 3

THE "AGEING" OF POPULATION

Prof. E. Rosset (Poland)

An important factor affecting the movement of population is the demographic situation itself, above all the "ageing" of population that is to be observed in all countries. Demographic old age is the lot of a small group of countries; it is an almost universal phenomenon in Europe, but is less common on the other continents.

Determination of demographic old age would be impossible without a preliminary determination of the beginning of old age. Its threshold is generally taken as 60 or 65; some researchers define its beginning as 65 for men and 60 for women.

In speaking of the "ageing" of a population we have in mind dynamic phenomena consisting in the numbers of old people increasing more rapidly than its other age groups. The manifestation of this process is consequently not absolute growth of the numbers of old people but increase in their relative weight in the total population.

The concept of demographic old age has a different character. It expresses a numerical ratio of some sort between old and young people at a certain moment, and is consequently a statistical concept.

There is no need to stress here that these two concepts—ageing and old age—are very closely linked: old age is the effect, the result of ageing. They are not, however, identical concepts.

We define the degree of demographic old age by what is called the rate of ageing. There are various ways of calculating it.

The simplest way and at the same time the method most often used is that in which the proportion of old people in the total population is taken as the measure of old age. If we take it that the threshold of old age is 60, then the formula for calculating the rate of ageing is written as follows:

$$K_a = \frac{l_{60+}}{L} \cdot 100,$$

where l_{60} is the population aged 60 or older, and L is the total population.

If we take the threshold of old age at 65, the formula then has the following form:

$$K_a = \frac{l_{65+}}{L} \cdot 100.$$

Other indicators of old age, less often used, we shall not consider here.

Evaluation of the degree of development of ageing is facilitated by "old-age scales". Let us consider two types of "demographic old-age scale".

The scale proposed by the writer of this paper is based on the number of persons aged 60 or over. We distinguish the following states:

I. demographic youth—under 8 per cent;
II. the first threshold of old age—8 to 10 per cent;
III. the threshold of old age proper—10 to 12 per cent;
IV. demographic old age—12 per cent or more.

This scale can be extended, dividing demographic old age into stages, as follows:

(a) initial stage—12 to 14 per cent;
(b) middle stage—14 to 16 per cent;
(c) advanced stage—16 to 18 per cent;
(d) very advanced stage—18 per cant or more.

UN demographers use a scale starting at 65, and comprising three different states[1]:

(a) a demographically young population—less than 4 per cent;

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[1] *The Ageing of Population and Its Economic and Social Implications*, United Nations, New York, 1956, p. 7.

(b) a demographically mature population—4 to 7 per cent;

(c) a demographically old population—7 per cent or more.

There are other "scales of demographic old age", but they are not widely used, so we shall not consider them here.

Such a scale, it must be noted, cannot be stable. Demographic relations in a population undergo changes with the passage of time; a scale that has been doing its job well then loses its value.

From the UN *Demographic Yearbook 1965* we calculated the proportion of persons aged 65 or older in the total populations of 129 different countries and areas. It follows from these calculations that there is immense variation in these ratios on a world scale; the coefficient of demographic old age varies from 1 per cent to 15 per cent.

Using the scale proposed by UN demographers we can say that 61 of the countries considered were young demographically, 37 mature, and 31 old. Our survey was obviously incomplete, since data on distribution by age groups were not available for all countries; and not all the data available allowed one to distinguish the groups aged 65 or older. In fact the number of countries whose populations were classed as demographically young is significantly larger than we could imagine; the number of countries with a demographically mature population is closer to the actual position, while the number with a demographically old population is nearly complete. We shall not adduce all the results obtained, but shall limit ourselves to analysing them.

The scale adopted was found to be imprecise in comparison with the empirical statistical data; it glossed over phenomena that deserve special attention, namely, the extremes of demographic youth and old age. The case of extreme youth of the population is often encountered in Africa. There one may find an age structure in which there is hardly a single old person per hundred inhabitants. One can say that it is a population without old people. At the other pole there are immeasurably more numerous groups of old people; in many European countries there is one old person for every eight inhabitants.

How do matters stand in this respect in the socialist countries? According to our calculations,

—the population of Albania, demographically speaking, is young (note: it is already one of the last oases of demographically young population in Europe);

—the populations of the USSR, Yugoslavia, Poland, and Rumania are at the threshold of demographic old age;

—the populations of Bulgaria, Czechoslovakia, Hungary, and the German Democratic Republic have reached the state of demographic old age.

We have also noted significant differences in the coefficient of demographic old age within the Soviet Union. We found the lowest proportion of old people in the Moldavian SSR. The data on the populations of the Kazakh, Tajik, and Turkmen SSRs prove to be close to this ratio. By the classification given above this part of the population of the USSR is in a state of demographic youth.

The highest proportion of people aged 60 and older is to be found in the Baltic republics. In them there is a state of demographic old age, which by our scale is in the middle stage of development of the ageing process.

Let us consider the data defining the dynamics of population ageing.

In 1950 fifteen countries were counted as demographically old (7 per cent or more of persons aged 65 or older), in 1960 twenty, and in 1965 thirty. The number of such countries consequently doubled in fifteen years.

In 1950 their populations constituted 18.7 per cent of the world's population, in 1960—19 per cent, and in 1965—19.7 per cent.

The dynamics of the ageing of the Soviet Union's population can be considered from a comparison of the number of persons aged 60 or older. On the present-day territory of the USSR there were 13 million people of that age in 1939; in 1959 the number in this age group was 19,700,000, and it has already in recent years topped 35 million. At the same time the proportion of old people (60+) in the total population was 6.8 per cent in 1939, 9.4 per cent in 1959, and was around 15 per cent in the mid-1960s. A similar evolution is observed in ageing of the populations of Poland, Yugoslavia, Rumania, and Bulgaria.

An extremely important aspect of the "ageing" of a population is ageing of that part of it that is called upon to play an active role in the process of production and in the process of carrying out economic plans, i.e., the population of able-bodied age. The phenomenon of "ageing" of this part of the population consists in there being relatively fewer young people and more and more people of older ages within the limits of the able-bodied population.

We investigated how this phenomenon is manifested internationally. We made the appropriate comparisons on the basis of an age classification in which the period of working life was taken as 45 years (from 20 to 64), dividing this period into two, necessarily uneven parts (a younger period of working age of 20 years, from 20 to 39, and an older period of 25 years, from 40 to 64).

The structure of the working population corresponding to this classification is shown in Table 28.

Table 28

Age Structure of the Working Population of Selected Countries around 1960

Country, year	Percentage of persons aged		Country, year	Percentage of persons aged	
	20-39	40-64		20-39	40-64
India, 1961	62.2	37.8	United States, 1960	49.1	50.9
Turkey, 1960	62.2	37.8	Switzerland, 1960	48.5	51.5
Japan, 1960	59.3	40.7	Federal Republic of Germany, 1960	48.3	51.7
Greece, 1960	55.7	44.3	Belgium, 1960	47.3	52.7
Spain, 1960	53.9	46.1	Denmark, 1959	46.4	53.6
Canada, 1960	53.9	46.1	Norway, 1959	45.6	54.4
Italy, 1960	53.6	46.4	Austria, 1959	45.6	54.4
Finland, 1960	51.0	49.0	Britain, 1960	45.1	54.9
Australia, 1960	51.0	49.0	Sweden, 1960	43.7	56.3
Holland, 1960	50.9	49.1			
France, 1960	49.5	50.5			

The indices of demographic old age for the working population varied from 37.8 to 56.3; the range of the variation was consequently 18.5. Dividing that by five we obtained the size of intervals that enabled us to distinguish five groups differing in their proportions of the working population as follows:

I from 37.8 to 41.5—very low
II from 41.5 to 45.2—low
III from 45.2 to 48.9—medium
IV from 48.9 to 52.6—high
V from 52.6 to 56.3—very high

These groups comprise the following countries:

I—India, Turkey, Japan (countries with a very young working population);

II—Greece (a country with a young working population);

III—Spain, Canada, and Italy (countries with a working population that is already not young, but is not yet old);

IV—Finland, Australia, Holland, France, the United States, Switzerland, Federal Germany (countries with an old working population);

V—Belgium, Denmark, Norway, Austria, Great Britain, and Sweden (countries with a very old working population).

In the countries of group V, and in most of those in group IV, the older fraction of the working population is bigger than the younger one. The fact that this state of affairs is found in almost all the economically developed countries deserves attention. It is in these countries consequently that the process of ageing of the working population is in fact most strongly developed. And only in them does the problem of a shortage of young workers manifest itself most acutely. In them, too, the problem of employing workers of older age is acquiring special significance. It is a question of how to make use of all the skills and accomplishments possessed by older, experienced workers in the best way and most fully in the interests of developing the economy and national culture.

The "ageing" of a population exerts a strong influence on all aspects of social life, on a country's economic affairs, and on social relations. Its first and natural consequence is that the part of society actively occupied bears increasing costs in supporting an increasing number of old people. Some bourgeois economists, it should be noted, express the view that every non-working person, everyone who consumes without producing, "burdens" society with

the costs of his or her maintenance. In our view that standpoint is incorrect.

The percentage relation of elements not involved in work processes to the population of working age can be measured. Various formulas are used for the purpose in accordance with the age classification adopted. In our calculations we relied on coefficients found from the following formula:

$$H = \frac{l_{65+}}{l_{20\text{-}64}} \cdot 100.$$

On a world scale there is a huge gap between the coefficients concerned: the lowest is four and the highest twenty-five. The difference, consequently, is sixfold.

Assuming that demographic scales should be constructed in accordance with practical statistical data, we would suggest a scale of coefficients divided into five groups, as follows:

under 5—"very low burden"
5 to 10—"low burden"
10 to 15—"average burden"
15 to 20—"high burden"
20 and higher—"very high burden"

Sri Lanka, Mali, Uganda, and Tanzania have a "very low burden". (This is a matter, naturally, only of the countries figuring in our calculations.)

We found a "low burden" in Indonesia, Morocco, Nepal, the Philippines, India, Thailand, Ghana, Venezuela, Turkey, Iran, Mexico, Peru, and Algeria.

The burden that we define as "average" falls to Japan, Argentina, Puerto Rico, Finland, and Spain. This group includes countries whose populations are already not young but have not yet become old.

We found a "high burden" of old people in Greece, Canada, Portugal, Australia, Italy, Holland, Switzerland, the United States, Federal Germany, and Denmark, which are countries where ageing has made considerable progress.

Finally there is a "very high burden" in Great Britain, Norway, Sweden, France, Austria, and Ireland.

Some researchers note a fall of natality among the demographic consequences of ageing, a point shared by Alfred Sauvy, and by Paul H. Landis who says that "it is possible that a large grandparent quota (group above

50) in proportion to the parent quota in the population (the group in the reproductive ages 15 to 50) may have an effect on the birth rate".[1]

There may be a kernel of truth in his remarks, that is to say, the expense of supporting aged parents may, in individual cases, actually affect the size of the family proper. But it is doubtful if one can raise that position into a principle.[2] For it may be expected that people will understand the two-pronged effect of that point of view: if they were to limit the number of their offspring in order to reduce their expenses, what will time hold out for them? Who will provide the means for their support? One cannot with impunity restrict the strata of that part of the people who must in the future take on the role of providers for their predecessors.

The level of mortality is closely linked with age. Whereas there is high mortality in infant years, it falls thereafter. Mortality is lowest among children around 12 years of age, then begins to rise, reaching its highest rates in the most advanced years of life. Mortality is even higher in advanced old age than in infancy.

One may readily conclude that the "ageing" of a population affects the death rate, since the proportion of aged persons who have the highest probability of mortality is increasing.

Some researchers have expressed disquiet in this connection. In his paper at the International Population Conference in Vienna (1959) Agapitides spoke of the likelihood of a rise in mortality in Greece as a consequence of the progressive "ageing" of its population.[3] The reduction in mortality achieved by then would, he said, be compensated by growth of the number of deaths among old people.

The possibility of a rise in the general death rate is very probable, but we cannot share his evaluation of this

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[1] Paul H. Landis. *Population Problems. A Cultural Interpretation*, American Book Co., New York, 1954, p. 100.

[2] S. G. Strumilin predicted, in an interesting forecast of the future, that reproduction would in time be characterised by high natality simultaneously with a high proportion of old people (see S. G. Strumilin. In Space and on Earth, *New Times*, 1961, 7).

[3] S. Agapitides. Mortality in Greece, *International Population Conference*, Vienna, 1959, p. 381.

phenomenon. If the mortality of any age group does not increase, but there is simply a general increase in the death rate as a result of the growing proportion of old people, there are no grounds for appraising such an evolution of mortality as undesirable.

The process of "ageing" also affects the course of population movement, giving rise to migration of persons leaving the arena of professional life. Some of them change their place of residence and settle down in localities better suited to the domestic conditions of already inactive people. In countries with a strongly developed "ageing" process, populated localities of a new type, "pensioner towns", appear.

The important question is what will be the ultimate effect of this process, in the sense of its effect on reproduction. Many researchers have expressed the view that "ageing" will lead to compensation of the numbers of births and deaths thereby terminating the further growth of the population. That is how we ourselves picture the demographic future.

Pictures of the future evolution of ageing rest on demographic forecasts. Everything that has been said about them, for and against, also applies to predictions of the future numbers of old people.

Two things, however, must be distinguished: (a) the absolute number of old people, and (b) their proportion in relation to the total population. The absolute number of old people can be determined with a fair degree of accuracy. The people who will enter this age group in the near future, and in subsequent years, are here among us; their numbers are known, and we can determine from mortality tables, with a high degree of probability, how many of them will depart life in the course of the next ten, twenty, or forty years (long-term calculations seldom go further into the future).

The data on the future proportion of old people are less accurate, as follows from the fact that we calculate a quite accurate absolute number of old people in relation to a less accurate determination of the total population.

Alfred Sauvy wrote, a quarter of a century ago, that the "ageing" process was far from completed. The intervening period has confirmed the correctness of his view, as

is shown by the long-term estimates made by UN demographers. According to them, the proportion of old people (aged 65 and older) in the total population by the end of this century should be as shown in Table 29.

Table 29

Presumed Development of the Proportion of Old People (Aged 60 or Older) in Selected Areas (after UN Data)
(1960-2000)

Region	1960	1970	1980	2000
East Asia	4.2	4.7	5.5	7.0
including Japan	5.7	6.9	8.6	13.7
South Asia	3.0	3.3	3.7	4.9
Europe	9.8	11.7	13.1	13.1
Africa	2.7	2.7	2.8	3.2
North America	9.0	9.2	9.4	8.9
Latin America	3.3	3.7	4.0	4.4
Oceania	7.8	7.7	8.3	8.5
Total:	4.9	5.4	5.9	6.5

If we apply their scale to the data in the table, differentiating three stages of development of the population (youth, maturity, and old age) we can draw the following conclusions: (1) a state of demographic youth will be preserved only in Africa by the end of the century; South Asia and Latin America will already by then have passed into the demographically mature group; (2) the state of demographic maturity existing in East Asia (including Japan) in 1960 will have passed into history by 2000; the sole representatives will be South Asia and Latin America; (3) the phenomenon of demographic old age could be expected to develop in Japan in the 1970s, and in East Asia as a whole by the end of the century; (4) the remaining regions (Europe, North America, and Oceania) were already in the group representing a state of demographic old age in 1960, and will obviously remain in that group; (5) "ageing" will progress continuously

on a world scale; the proportion of old people in the total population, which was 4.9 per cent in 1960, will rise to 6.5 per cent by the end of the century. Furthermore, in 1960 there were nearly 150 million people in the world aged 65 or older; in 2000 there will probably be 400 million.

Japanese demographers predict that in the next half-century their country will become the arena of an unusually rapid process of population ageing. The proportion of old people (65 or older) may rise there as shown in Table 30. It is envisaged that in the final phase of the projected period (2015) there will be more old people in Japan than children under fifteen.

Table 30

Expected Ageing of Japan's Population

Year	Percentage	Year	Percentage	Year	Percentage
1960	5.7	1980	8.2	2000	12.8
1970	7.0	1990	9.6	2015	17.7

Source: *An Outlook of Studies on Population Problems in Japan, Retrospect and Prospect.* Japanese National Commission for UNESCO, 1962.

The two facts known to us, namely, (1) the systematically progressing growth of the numbers of old people (obvious from comparison of regular population censuses), and (2) the continuous growth of the numbers of people surviving to old age (obvious from comparison of mortality tables), are an expression of quantitative changes associated with ageing. The question arises whether or not qualitative changes are also taking place, consisting in an improvement in the physical and other characteristics of old people, in an improvement of their fitness compared with preceding generations.

Many researchers give an affirmative answer to that question, stressing that, with the development of culture, and the advance of science and technology, old age is

shifting to older and higher ages. In primitive society old age set in already between thirty and forty years of age. In modern advanced society the threshold of old age is associated with an incomparably higher age.

Present-day existing pension schemes exert some influence on this. In European countries men go on old-age pension at 60 or 65, and women five years earlier, which can serve as an indication of how far humanity has left behind the primitive state inherent in earlier epochs of its existence. Old age has been postponed by several decades.

The process of staving off old age has not been completed. Since human life is being prolonged, old age cannot help being put off. It seems unlikely that the factors operating to prolong human life can remain without effect on people's capacities at an older age. Lengthening of the human life span and the staving off of old age, in our understanding, are two inseparably linked phenomena.

The relations stressed here are of great significance for the future. If the main source of the "ageing" of populations has hitherto been the fall in natality, in the future (and perhaps not so far ahead) the role of driving force will be taken over by the decline in mortality, especially among people in older age groups. In the Soviet Union the need for sensible action in this direction is already being considered, and the theoretical basis and practical measures are being worked out accordingly for prolonging life and fitness for work.[1]

The Soviet demographer Boris Urlanis informs us that "great efforts will be directed to combating the diseases of old age. The old age of Soviet citizens must be active, and much is being done to make it so for all members of our society".[2]

Generalising the experience of the Soviet Union and other countries, we can say that science and social practice are facing a whole complex of new and extremely important problems connected with changes in the life of modern societies relating to the very process of the "age-

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[1] Much work is being done in this direction by the Institute of Gerontology of the USSR Academy of Medical Sciences in Kiev (director D. F. Chebotarev).

[2] B. T. Urlanis. *Rozhdayemost i prodolzhitelnost zhizni v SSSR* (Natality and Life Span in the USSR), Moscow, 1963, p. 129.

ing" of population as a consequence of the demographic situation. Some of these problems are the following:

(a) can the established threshold of old age remain immutable?

(b) is it right to retire people on pension on the basis of some certain chronological age or another?

(c) is it not socially extravagant to release people from work who are still capable and desirous of working, and who have enormous occupational and life experience?

(d) what should be done so that the extended autumn of life will be made as carefree and socially useful as possible?

All these problems call for serious investigation. Socialist society has all the prerequisites for resolving them in full harmony of social interests with those of the family and the individual.

Chapter 4

PROBLEMS OF MODERN URBANISATION

B. S. Khorev, D. Sc. (Geog.)

Socio-demographic processes are linked in many ways with the problem of urbanisation. The growth of towns, especially big ones, the growing weight of the urban population in various countries and in the world, and the spread of an urban way or style of life cannot help affecting population. But then the question arises of how to quantify these processes. Above all, can we, in general, define the concept "city" ("town") more or less accurately?

With growing urbanisation the seemingly paradoxical situation arises that the concept "city" ("town") itself is more and more transformed, and even more eroded; and this erosion occurs on various planes—economic, social, areal, and demographic.

It is commonly accepted that a town or city in the economic sense, i.e., an urban settlement, is primarily a populated point unconnected with agriculture as regards the predominant employment of its inhabitants. In the USSR this applies to the main criteria considered in creating new towns and settlements, and is reinforced by legislation. In spite of the existence of individual agricultural towns (*agrogoroda*), this definition still retains its selective validity based on the far-reaching differences between industrial and agricultural work. "The division of labour ... leads at first to the separation of industrial and commercial from agricultural labour, and hence to the separation of *town* and *country*...."[1]

[1] Karl Marx, Frederick Engels. The German Ideology, *Collected Works*, Vol. 5, p. 32.

Analysis of the essence of urbanisation from the economic aspect follows directly from theoretical propositions on the severance of the population from agriculture with the development of large-scale machine industry, and from the law of growth of the industrial population at the expense of the agricultural.

But does this growth go on solely within the confines of towns? The facts indicate that the stratum of industrial population is also increasing all the time in rural localities, converting more and more rural settlements into a sort of non-agricultural settlement, industrial, transport, service, and into "dormitory branches" of near-by urban centres. Many such settlements also begin to "catch up" in size, if not with towns at least with settlements of urban type, i.e., the administrative type of urban settlement taken in the USSR as a kind of intermediate stage between a town and a village. Finally, modernisation of the methods of farm work and the transformation of the whole social face of the village is undermining the very basis for delimiting town and country according to their inhabitants' type of employment, since agricultural work is becoming more and more like industrial. The spread of non-farm work is embracing not only towns but also rural localities, even in the most remote areas.

The transformation of the concept "town" ("city") is particularly striking when analysing urbanisation on the areal plane. As a form of the settlement of people on a territory, towns have long been associated in our minds with places where people were gathered together, dwellings were concentrated, and roads converged and crossed, as well as with places where non-agricultural activity was concentrated (industry, commerce, transport, etc.). The concept is inseparably linked with the idea of some sort of centre, functional, populous, residential. One can even say that the performance of the various functions of such a centre is no less typical of towns than their industrial role. In that sense towns, as centres, have long been foci as it were of the territorial structure of settlement, but at the same time have remained simply separate, though focal points on the map.

The essence of new changes introduced by urbanisation in the territorial aspect is that a town as a point form of settlement is passing into a wider urbanised zone or

"urban region", distinguished by a community of the population's everyday life. Together with the spread of industrial activity to rural localities villages adjoining towns are also being transformed outwardly into an "urban type"; built-up areas stretching along transport routes gradually link up and merge, extending urbanisation of the area.

The specific character of the built-up area and of the concentration of housing can no longer serve as a reliable criterion for defining a town. There remain only the administratively established "town or city limits"; but there is a tendency, not only for the urbanologist but also for the state statistical services of a number of countries in which the process of urbanisation has gone further than in other places, for the statistical classification of populous places to reach beyond the traditional consideration of a town within its limits, and to introduce concepts dringing us closer to an "actual town" in addition to the concept "administrative town".

Area-wise urbanisation leads to a town being transformed into a conurbation (or agglomeration), conurbation being the rule and not the exception for big cities. In the most urbanised countries cases occur of the growing together of separate urban agglomerations and the forming of group forms of urban settlement that can be called "urbanised regions". Individual urbanologists see in them the prototype of the future settlement of mankind. But even if the network of settlement were to develop in another way in the future, the concept of a city, in the spatial sense, would still, it is clear, become more and more indeterminate in the epoch of conurbation.

In the social aspect modern urbanisation means the wide spread of features of an urban way of life in small towns and rural areas (i.e., a complex of specific living conditions and their consequences inherent primarily in cities). In that it "contradicts" as it were the process of urbanisation on the demographic plane, meaning the mass flow of population from country to towns, as a result of which the proportion of the urban population in any one country, and in the world, is almost constantly increasing. In the one case people migrate from the country to the cities, being drawn somehow by the urban way of life;

and in the other case urban "values" (including features of demographic behaviour) become the property of the population of the rural localities drawn into the orbit of cities, and even of more remote peripheral areas, i.e., the two trends are meeting half way.

The clearest and most interesting phenomenon among all the signs both of the transformation of the concept "town" on the socio-demographic plane and in general of the development of all the main aspects of urbanisation described above (economic, demographic, areal, and social) must be considered the "pendulum migration" or commuting of population, which is becoming more and more pronounced in many countries.

This phenomenon has been largely underestimated hitherto. It is usually analysed mainly only from the angle of the solution of transport and planning problems in suburban zones. The spread of such links is presented as a deviation from normal development, and as such, of course, poses the problem of limiting it.

In fact commuting is a natural and very characteristic phenomenon of the modern phase of urbanisation.[1] Its broad development means the creation of quite new conditions for the social and territorial mobility of population, for opportunities of choosing one's job or profession, for planning the leisure of the inhabitants of broad areas surrounding urban centres and linked with them by modern forms of transport. If we consider the matter in its broad social and demographic aspect, we can suggest that the migration of population from country to town is already being replaced, and in the long run will be increasingly so, by commuting, since the basis for both is in essence the same, namely, people's settling in relation to the places of application of their labour.

The development of fast passenger transport leads to the radius of the settlement of commuters being extended in urbanised areas; now it stretches for dozens of kilometres. It is not excluded that the radius will soon stretch for hundreds of kilometres, which will in fact mean transition to a new phase of urbanisation. It is also not difficult to imagine the coming of a time when any person

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[1] In recent years our suggestion has been more and more widely accepted.

will have free choice of place of work irrespective of place of residence with a quite acceptable expenditure of time on the daily journey to and from work. In these conditions the slogan of "fighting commuting" can, of course, only be acceptable in special cases. Consequently it should rather be a matter of the need for far-reaching study and regulation of these processes.

We suggest that commuting should now be considered one of the main criteria for measuring the degree of urbanisation of an area or of a country as a whole. It is not enough to say, in this case, that around half a million persons travel every day from the suburbs to Moscow to work and study, and to Paris a million. One needs to evaluate this phenomenon on a national scale in the same way as, for example, we establish the proportion of the population considered urban. In the interests of science and of practical affairs we must elucidate what, for example, is the percentage of commuters among the workers and employees of any town, area, or country as a whole. It can be supposed that, in a country as large as the USSR, daily journeys to and from work from various settlements are made by at least 12 per cent of the mean annual number of workers and employees (including students in higher and specialised secondary educational establish ments). It has been established that the proportion of commuters is even higher in some other countries (in Poland, for example, more than 20 per cent of all workers and employees, in Hungary 12.5 per cent).

In its first stages of development regular commuting embraces mainly the residents of suburban areas who, while continuing to live in their settlements, begin to seek work in urban centres. Cities attract people from further away, and the new arrivals often settle in the suburbs and work or study in the city. In this connection everyday labour links begin to be more and more developed. In several European socialist countries the stratum embracing commuters in the rural population already applies now to a special category of "peasant-workers"; and one speaks of "mixed country-urban zones" adjoining urbanised areas.

In individual capitalist countries, mainly in the USA, commuting has entered a new stage in which there is a mass exodus of the residents of cities to suburban zones.

The "flight from the city" is the basis of what is called suburbanisation. Without railways there would have been no tempestuous growth of towns drawing labour from the country; and without the motor car there would have been no suburban form of urbanisation. In the first two decades after the war the number of Americans living in the suburbs of the cities nearly doubled. These were already not "peasant townsmen" but true townsfolk, frequently living dozens of kilometres from their places of work.

Thus the concept "town" ("city") is quite inadequate to express the processes of urbanisation. Neither the nature of employment, nor the areal concentration of housing, or way of life, can now provide an adequate basis for defining a town. One might even say that the town has given way to urbanism if that concept, too, were not perhaps just as indeterminate, if not more so. Nevertheless, the essence of urbanisation can be elucidated despite the indeterminateness of the initial concepts. The real difficulties show up at the stage of quantifying the process.

It is time we evolved indices characterising this process, taking such criteria as non-agricultural work, suburbanised area, the scale and radius of commuting, and so on, as the starting point in all accounts. It is a waste of time, in our opinion, the more so as it is methodologically incorrect, to seek some kind of general "measure of urbanisation". The fact is that the very opposing of the way of life in town and country conditions is out of date, since these conditions are becoming levelled out in the USSR; and in the socialist countries this levelling out is the basis of the settlement policy.

In order to picture the "mechanism" of urbanisation more clearly it is advisable to consider what the channels of city growth are.

They are (1) the natural increase of the urban population itself; (2) the increment to the urban population from the rural population, so-called mechanical growth; (3) the founding of new towns and cities; (4) the inclusion within a city's limits of its suburban areas, or their administrative subordination to it (including towns, communities, and villages); (5) the transformation of rural communities into urban ones. Between 1926 and 1970 mig-

ration from the country accounted for 57 per cent of the growth of urban population in the USSR (105 million persons), natural increase of the urban population for 26 per cent, and the conversion of rural communities into urban ones for 17 per cent.

The actual growth of towns, however, follows yet another channel. More or less broad suburban zones and urbanised areas are formed. The whole way of life of the population in these areas comes more and more to resemble the conditions of living in the cities that are the centres of the zones. In this process the city-centre often serves as the centre drawing labour to the zone and giving rise to daily commuting of the population. The first five "components" directly affect the numerical characteristics of urbanisation quantitatively; the sixth, which is not allowed for, or only partially so, means in fact a real qualitative shift in the urbanisation process, and in settlement in general.

One can quite imagine a situation in which natural increase of the town population is falling but the pace of urbanisation remains high because of high mechanical growth. This, incidentally, has been characteristic of many large cities in the USSR. The passage of rural population to the city can slow down or even cease, and a statistically recorded shifting of population from the cities (mechanical outflow) can be observed, while urbanisation continues in connection with growth of its new forms, and especially through commuting. Is that not in fact the essence of the latest phenomena of suburbanisation and urbanisation in the USA, which are not evidence at all of a cessation of urbanisation but of its transition to the stage of "hyperurbanisation"?

Thus urbanisation cannot be reduced one-sidedly to one of the phenomena associated with the process. In view of that we must comment on the rather narrow character of the terminological interpretation of urbanisation used by specialists. We have already listed the main aspects of the process characterising its essence; but one might mention others, e.g., the technical aspect. There is even a "recipe" for radical solution of the problem of towns on a purely technical basis, namely, through the building of overground, underground, marine, and even "space" cities.

Transformation of the concept "city" is leading to this, that some researchers in recent years have been distinguishing between cities and the concept of urbanisation, considering the latter primarily a process of the concentration of intercourse between people. If we take a Marxist view of urbanisation as a phase in the division of labour between town and country, then the concept of urbanisation naturally proves to be inseparably linked with "city". In that connection the question arises whether we can still, despite the transformation of this concept on various planes, recognise it at this stage as something specific on the theoretical plane, and consequently whether it has any claim to exist.

We have already spoken of the ideas with which the concept "city" is linked. That leads us to a definition of its specific character on the theoretical plane as a place of complex concentration in a system of territorial division of labour—demographic, material and technical, and informational. "The town is in actual fact already the concentration of the population, of the instruments of production, of capital, of pleasures, of needs, while the country demonstrates just the opposite fact, isolation and separation."[1] The specific feature of the town on the plane mentioned above by no means disappears at a given stage of its development.

The conception of a "city-region" (or an "areal urbanistic model"), which in fact is based on the idea of some deconcentration or other of the functions of the big city, and the conception of a "united system of settlement" based on considering it as a hierarchically co-ordinated and functionally interconnected network of communities of different rank and type within a framework of areal-social complexes of various size (employing cybernetic approaches) both in fact have their basis in the conception of complex concentration (the bigger the city the higher the complexity).

In connection with the above conception of the modern city we understand the basic meaning of urbanisation as a process of concentration and complication of functions in a network of populated places. At the highest stage of this process the gradual crystallising out of functional unity in the network of communities prepares a quali-

[1] Karl Marx, Frederick Engels. *Op. cit.*, p. 64.

tative leap that transforms it into a single, very closely interknit system within which broad decentralisation of certain functions is dialectically determined and in fact occurs. Such is the basic trend of urbanisation, which is becoming manifest in the course of today's scientific and technological revolution and is to a considerable extent due to it.

World urbanisation can still only be depicted in the demographic aspect and very approximately at that. It is customary to base the process of urbanisation of population and its comparative analysis in different countries on data on growth of the proportion of the urban or urbanised population, for which the population of all communities of a certain size (population) is taken (the official definition of them in different countries is not always the same). The result of the calculations thus depends on the accepted world statistical qualification of the populousness of a town.

It is not the growth of cities in general, however, that is most characteristic of the contemporary phase of urbanisation, but the concentration of population in large and super-large cities. It is the growth of cities (with a population above 100,000 inhabitants) and the new forms of settlement associated with them, and the spread of the specific way of life accompanying it, that most clearly expresses the urbanisation of a population. Cities, especially super-large ones with more than half a million people, usually considered with their surroundings, have even received a special name in the literature of many countries; they are already not simply cities but metropolises, i.e., big cities or capitals. "Metropolitan zones" are distinguished, and even "regions". Urbanisation and "metropolitanisation" are not one and the same thing. "Metropolitanisation" is the growth of large or super-large cities, but mainly their growing together with ever extending suburban zones, and the concentration of population in "urbanised zones" dominated by a large central city.

The stage-by-stage course of urbanisation, the outstripping growth of an industrial, non-agricultural, urban, and urbanised population in comparison with a rural and agricultural one, and of a big city population compared with the population of towns and communi-

ties, and metropolitanisation are the most characteristic features of world urbanisation. The rapid changeability of the processes, and of the forms in which they manifest themselves, engenders an instability and lack of clarity not only in the long-term perspective but also in the immediate future. The fact that these processes are taking place with the coexistence on one planet of different social systems and of numerous states, in conditions of irreconcilable conflict of the ideologies of socialism and capitalism, in conditions of social upheaval and international conflicts, and in an age of scientific and technological revolution leaves a vast impress on all these phenomena.

In these conditions it is very difficult to speak of the positive and negative features of urbanisation or metropolitanisation as such, out of context of the diverse socio-economic, national-state and natural-geographic forms of the modern world. Only certain norms can be defined, the general character of which is confirmed by many facts, to wit:

(1) growth of industrial population at the expense of the agricultural population is a law; consequently the outstripping growth of towns is quite natural;

(2) the historical process of urbanisation is at bottom a progressive phenomenon; it has become almost axiomatic to recognise the city as the cradle of human culture and the highest form of the organisation of human life; its progressive role is mounting in modern times in connection with the concentration of the working class, the bearer of socialist ideology, in cities, and also in connection with cities' role as centres of scientific and technical progress ("We know... that the towns are centres of the economic, political and spiritual life of the people and are the chief vehicles of progress"[1]);

(3) the danger is the spontaneous and uncontrolled course of urbanisation, deepened by the antagonistic contradictions of capitalist society; in particular, with the present-day scientific and technological revolution in progress, a root problem of urbanisation is associated with disturbance of the dynamic balance between man and nature.

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[1] V. I. Lenin. Fresh Data on German Political Parties, *Collected Works*, Vol. 19, p. 270.

It would seem to be a fact that already by the end of our generation town-dwellers will be converted from a minority in the whole world to a majority. Various forecasts suggest that by 2000 from 70 to 90 per cent of the world's population will be living in cities. Forecasts of the total world population in 2000, it is true, vary by a wide margin in the various estimates, from 5,300 to 6,800 million. One writer states that, unless urbanisation slows down, "more than half the world's population will be living in cities of 100,000 or more by 1990".[1]

In three parts of the world—Australia, North America, and Europe—the inhabitants of cities already predominate, and Latin America, which is being rapidly urbanised, is catching up with them, while the population of Afro-Asian countries, because of its large numbers, gives the country a numerical preponderance over the town for the world as a whole. At the same time there are specific types of urbanisation which differ markedly, above all in countries with different social systems.

Many developing countries, while characterised by a comparatively low index of urbanisation (10 per cent on average according to UN experts), are distinguished by a relatively higher tempo of urbanisation. This is particularly manifest in the case of the tempestuous growth of the capitals of the former colonial countries of Asia and Africa that occurred after independence. A disproportionate growth of capitals is characteristic in general of many developing countries and is linked with the special type of urbanisation in them, which is marked by the mass attraction of peasants to cities, above all to the capitals, in which they see salvation from poverty and hunger. The attraction is manifested independently of any growth in demand for labour in the towns, the flood of villagers to the towns greatly outstripping the growth of this demand; migration from country to town is increasing the army of unemployed and semi-unemployed, and extending the slum areas arising on the outskirts (*bidonvilles*).

In developing countries urbanisation is an extremely contradictory process; on the one hand, it promotes

[1] K. Davis. The Urbanisation of the Human Population, *Scientific American*, 1965, 213, 3:41.

their progress, drawing millions of new people into active political life, creating the basis for growth of the ranks of the working class, raising the role of towns in their life and in the national liberation movement and the struggle for social progress; on the other hand, it is intensifying the socio-economic problems caused by colonialism and backwardness and linked with extreme "demographic pressure" in cities.

The contemporary type of capitalist urbanisation is now not so much a rapid rate of increase of the percentage of the urban population (which is already quite high in any case) as a particularly intense development of the processes of metropolitanisation, and the formation on that basis of new areal forms whose development is extremely contradictory and accompanied with a "crisis of the city".

The developed capitalist countries are now already feeling the full effects of spontaneous urbanisation and growth of cities. Particularly acute problems are arising with the growth of megalopolises. One of the chief problems is lack of water; to overcome it will require enormous capital investment. In the biggest American cities the overcrowded ghetto areas, in which the poorest of the population are huddled together, are continuing to expand. Air and water pollution is worsening living conditions in the largest conurbations and threatening ecological catastrophe.

Americans also point out other negative consequences of spontaneous urbanisation in the capitalist world, namely, "a general lowering of business activity", i.e., deterioration of the conditions for land use, housing, and engineering works; and depreciation of real property in cities.[1] Capitalist "urbanism" in sum is turning against the very system of big business.

Capitalist society, it transpires, is incapable of overcoming the monstrous growth of super-cities and conurbations and of regulating use of a country's territory for the siting of industry and settling of people.

Socialism presents an opportunity to use the best achievements of the modern urban form of settlement for the

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[1] See G. E. Breger. The Concept and Causes of Urban Blight, *Land Economics*, 1967, **43**, 4:369-76.

broadest masses of the working people. Let us recall that one of the first measures of the Soviet government was the mass rehousing of the poor from slums and basements in the well-built flats where the bourgeoisie had lived before the revolution. Let us recall that class and race segregation in the cities of capitalist countries in no small measure governs the architectural and town-planning structure of settlement.

The path of spontaneous growth of cities into "super-cities", or giant cities, is not at all inevitable for urbanisation in socialist countries, which differs fundamentally in its social aspect from capitalist urbanisation with its characteristic sharpening of class contradictions. Urban agglomeration is a form of community that can develop differently in different socio-economic conditions, given the existence of greater or less opportunities of controlling metropolitanisation.

The type of urbanisation in socialist countries is inseparably linked with socialist industrialisation in a planned economy. It must not, however, be understood by that that urbanisation coincides absolutely with the level of industrialisation. It is a matter rather of the relative proportionality of the socio-economic processes, in which there are no objective grounds for breach of the proportions in the growth of industry and urban population, or for extreme demographic pressure on the cities, because all these phenomena are subject to economic and administrative control under a socialist planned economy.

At the same time the contradictory character of the present stage of development of towns in the USSR must be stressed. The contradictions in this field are by no means limited, for example, to the correlation of regulation by administrative measures and the requirements of the economic laws of development of the economy. From the angle of controlling the growth of towns the disparity between living conditions in communities of various size and the needs of economic development are much more significant. In particular, industrial concentration in separate cities, even when it is efficient from the aspect of industry, frequently comes into collision with improvement of the population's living conditions. In this connection the role of centres of concentration of manpower should in no way be appraised simply. The conception

of a "single system of settlement"[1] that has been developed in the USSR is aimed in essence at resolving today's disproportions in the growth of towns, and that is its significance at present.

What we call the "single system of settlement" is a certain hierarchical model of communities built up on the basis of a multinomial taxonomic scheme of economic regionalisation of the country, in which communities of various size and type are given planned and proportional development in accordance with their functional purpose, with the aim of ultimately achieving equal conditions of habitat (or relatively equal working and living conditions) over the whole territory of the developed part of the country. This is only one aspect ("settlement") leading to achievement of these aims.

The concept of a single system of settlement as our starting point also extends and specifies opportunities for structural-geographic modelling of the network of populated points (the network of settlement), and for controlling the growth of cities at the present stage. The theory of economic regionalisation, it must be stressed, and of the forming of regional production and territorial complexes, developed in detail in the USSR, should serve as one of the bases of a concept of systemic settlement. The so-called regionalisation of settlement, which can be carried out independently as a method of understanding the concrete features of settlement, can only serve constructive ends on the basis and within the limits of economic regions of different standing. Correspondingly, the stages of the hierarchy of base centres in a single system of settlement should correspond to economic regions of different standing.

The six-element taxonomic scheme suggested can, of course, be given precision in some of its parts, but on the whole it can be regarded in principle as the hierarchical "skeleton" of a single macro-economic system of settlement for the USSR (see Table 31).

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[1] See D. G. Khojayev, B. S. Khorev. The Conception of a Unified System of Settlement and Planned Regulation of the Growth of Cities in the USSR. In the symposium *Problemy urbanizatsii v SSSR* (Problems of Urbanisation in the USSR), Moscow, 1971; and B. S. Khorev, *Problemy gorodov* (The Problems of Towns), Moscow, 1971.

Table 31

Taxonomic Scheme of the Hierarchy of Base Points for a Single System of Settlement

Region	Centre
Separate locality within a lower administrative district	Local centre
Lower administrative district (*rayon*)	Centre of a lower administrative district
Intra-regional "area" (*okrug*)	"Area" centre
Region (*oblast*), autonomous republic, and Union republic without regional divisions	Regional or republican centre
Major economic region	Centre of a major economic region
The country as a whole	The capital

The basic load in drafting a single system of settlement at the present stage is borne by intra-regional, "area" centres, which are a new element in the general system standing between the centres of republics or administrative regions and the centres of lower administrative districts. These "area" centres are in fact, in present conditions, the main connecting link between territorial schemes of macro-economic planning and town planning. That is the main point to regional planning. As an example we would cite the fact that, as a rule, the projected development of a city (a republican or regional centre) is now already usually decided in integral unity with development of its suburban zone usually commensurate with a central intra-regional area. The drafting of a single system of settlement at area level is done on the basis of tying the territorial location of industry in with the general labour balance for the whole area (including commuting) and a complete territorial scheme for all-round, integrated and uniform servicing of the urban and rural population.

The general scheme of settlement for the USSR should include a scheme of area centres as new centres of social activity and supplementary base centres of settlement. Long-term population growth should be determined not

simply by categories of cities, but mainly by areas, the basic nuclei of the single system of settlement.

At present long-term schemes for the location of the productive forces are in existence for almost all the economic regions of the USSR, while for many territories there are district planning schemes, analysis of which provides an exact map of the areas in each of which equal conditions need to be created in order to provide employment and basic services for all the inhabitants. In that way more complex, multifunctional development will be provided for a much larger number of urban centres than happens now with the regional (*oblast*) system (around 500 to 700 units instead of 150).

The concept of multifunctionality is a most important factor in the growth of towns in general, and follows primarily from their scientific typification. The most important role in the scheme of urban typology is played by the factors of size, functional structure, and area-organising role, taken together.

The main methodological conclusion for purposes of forecasting the network of towns is as follows. For this purpose the greatest significance is attached, on the one hand, to the modern functional type of town (if any town has already been developing for decades, or even for hundreds of years, as, for example, the local organising centre of a rural area, then it will follow this path until 2000 with all the planning consequences stemming from that), and, on the other hand, to the place of the concrete town in our draft taxonomic scheme (whether regional, areal, conurbation, etc.). It is necessary, however, for the functional type of town to be employed in the statistics, as well as its size.

Chapter 5

DEMOGRAPHIC PROCESSES IN THE SOCIALIST COUNTRIES OF EUROPE

V. V. Bodrova, Cand. Sc. (Econ.)

Far-reaching socio-economic changes have taken place in the socialist countries in the three post-war decades which are bound to affect demographic processes.

The industrialisation carried out in them entailed a heightened demand for labour in industry (especially in the first years), which was met by working hands from rural localities. That increased the proportion of the urban population in each of these countries; in addition, the emancipation of women led to wide use of female labour in social production. At the same time there was a rise in material prosperity and an accompanying rise in the cultural standards of all social groups. All that has directly or indirectly affected the processes of natural population movement.

One and the same factors associated with the socialist transformation of society have acted on the process of reproduction in this period under the new socio-economic formation. Nevertheless, the basis of their operation and the force of their impact on the reproduction process has varied in the different conditions, in the different countries, and within separate economic areas of one and the same country.

In 1950 the European socialist countries could be arbitrarily divided into several groups according to their birth rates, as follows: I (with a relatively low birth rate) — the German Democratic Republic, Hun-

gary, Czechoslovakia; II (with an average birth rate)—Bulgaria, Rumania, and the USSR; III (with a high birth rate)—Poland and Yugoslavia. Albania stood by itself, and had the highest birth rate compared with all the rest. The amplitude of the variation between the highest and the lowest rates was 22 per thousand in 1950, i.e., the highest rate (Albania) was 2.3 times the lowest. The lowest death rate in 1950 was in the USSR, which was the result of the progress of socialist construction in that country. The highest death rates of all were in Albania and Yugoslavia. The variation in death rates was not so great as with birth rates; the highest (in Albania) was approximately 40 per cent more than the lowest (in the USSR).

Table 32

Natural Population Movement in the European Socialist Countries in 1950-70

(per 1,000 persons)

	Natality		Mortality		Natural Increase	
	1950	1970	1950	1970	1950	1970
USSR	26.7	17.4	9.7	8.2	17.0	9.2
Albania	38.5	35.6	14.0	8.0	24.5	27.6
Bulgaria	25.2	16.3	10.2	9.1	15.0	7.2
Hungary	20.9	14.7	11.4	11.6	9.5	3.1
GDR	16.5	13.85	11.9	14.1	4.6	0.25
Poland	30.7	16.7	11.6	8.1	19.1	8.6
Rumania	26.2	21.1	12.4	9.6	13.8	11.5
Czechoslovakia	23.3	15.9	11.5	11.5	11.8	4.4
Yugoslavia	30.2	17.6	13.0	9.2	17.2	8.4

Although the birth and death rates are very general indices, even so analysis of them gives an idea of the motley character of the demographic situation existing in the 1950s.

Along with the socio-economic changes in the post-war period in these countries population processes altered too, although it must be said at once that the impact of the socio-economic factors on them was multiform and it is very difficult to establish the effect of each separate factor on natural population movement.

Restoration of the economies shattered by World War II was completed at the beginning of the 1950s. This was the time of the so-called compensatory period, when the birth rate in all the European socialist countries (except the GDR) was above the pre-war level. This period of increased natality continued in all the countries from approximately the end of the war to 1950-51 (but in Albania until 1960-61), after which natality began to fall.

In addition to the normalisation of life with the end of the war, the increase in natality in the first post-war years was favourably affected by the first social changes that began to be made as these countries embarked on the socialist path of development. But the so-called compensatory factors were of decisive influence, and a period of falling birth rates set in in all the European socialist countries early in the 1950s (except Rumania). The drop between 1951 and 1970, it has been estimated, was almost one-third on the average.

The question arises whether or not this fall in natality was a negative phenomenon. In our view, a lowering of natality is far from always negative. In the post-war years there was quite high infant mortality in the countries of Central, Eastern, and South-East Europe so that, although natality is now much below the pre-war level in several of the socialist countries, its fall in most of them has been slower than the reduction in infant mortality.

The birth rate fell most rapidly between 1951 and 1970 in countries with average or high natality: in Yugoslavia and Poland by 42 to 45 per cent, in the USSR and Bulgaria by 35 per cent; in Hungary and Czechoslovakia by 30 to 32 per cent, in the GDR and Rumania by 16 to 20 per cent, and in Albania by 8 per cent.

Apart from the factors about which we have already spoken, the birth rate also depends on the age structure of a population; but trends in the development of natality and mortality in turn are fundamental in moulding age structure.

Birth rates rise quite regularly with a rise in mortality and fall with a decline. This pattern stems from differences in age-specific death rates and the age structure of the population, even given different conditions of mortality. Mortality is maximum, as we know, in early

childhood and in the most debilitated old-age groups. With a fall in mortality, therefore, the proportion of children and old people increases most rapidly and the weight of the married age group falls, and thus the number of births per 1,000 population of all ages. With an increase in the proportion of older age groups there is quite understandably a reduction (other conditions being equal) in the number of persons of marriageable age, which in turn affects the number of births per 1,000 persons of all ages.

Comparing the age structure of these countries before World War II and in the first twenty post-war years, we can note a systematic fall in the percentage of the 0-14 (0-15) and 15-59 (16-59) age groups in the total population, and an increase in the proportion of people aged 60 and older (ageing of the population).

As a result of the fall in natality over a number of years and the ageing of the population there has been a certain slowing down of population growth rates (see Table 33).

Table 33

Population Growth Rates in Socialist Countries
(in percentages)

Years	1951-55	1956-60	1961-65	1966-70
Growth rates	1.45	1.45	1.25	0.9

This trend will be maintained and is sure to affect the supply of labour in the immediate future; those being born today will reach working age and be training for socially useful work in 15 or 16 years' time. In the long term the growth rates of the able-bodied population will slow down owing to the character of the development of the demographic processes.

Socialist society is not indifferent to the demographic processes taking place in it. All socialist states are carrying out a policy in the population field that includes socio-economic measures aimed at improving health, lowering mortality, prolonging life, and improving the people's material and cultural standards, measures that

are being implemented in accordance with the requirements of the basic economic law of socialism.

In addition to their demographic policy up to 2000, some European socialist countries are implementing a set of measures aimed at altering the parameters of natural population movement, age structure, and migratory processes in the direction desired by society.

The different birth rates in the different countries, and in various areas of one country, have been moulded by the effect of objective conditions; the subjective factor therefore cannot operate as the decisive one. It is important, therefore, for state measures not to contradict the objective conditions but to reinforce them to the greatest extent possible.

In countries like Czechoslovakia, the GDR, Hungary, Rumania, and Bulgaria the main task of demographic policy at present consists in the following: (a) prevention of a decline in natality, so countering the building up of an unfavourable age structure; (b) the preparation of conditions that will give families the chance to have more children without lowering their living standards compared with families without children.

Experience in implementing demographic policy can be illustrated from the examples of Czechoslovakia and Hungary.

In Czechoslovakia a broad system of measures has been introduced aimed at raising natality, mainly a differential system of taxes on workers' and employees' earnings and a system of so-called family allowances. Between 1960 and 1970 the law on mother and child was amended several times. By the law of 26 March 1964 on improving care for pregnant women and mothers, the length of paid maternity leave was raised to 22 weeks (previously 18 weeks); since January 1968 it has been lengthened to 26 weeks, and to 35 weeks with the birth of twins or triplets (with two living children); paid maternity leave for single mothers has also been increased. Working women who are bringing up children under 15, and pregnant women have the right to a shorter working day or a reduced working week. All women, on the birth of a child, receive a cash allowance of 2,000 korunas (and on the birth of a triplet a supplementary allowance of 9,000 korunas).

Rents are reduced for families with children, depending on the number of children under 18 in the family (by 5 per cent for one child; by 15 per cent for two children; by 30 per cent for three children; and by 50 per cent for four or more children).

The Czechoslovak Government, which is paying much attention to the problem of raising natality in the country, set up a State Commission on population problems in 1967 as a consultative body,[1] in addition to adopting measures to improve the financial position of big families. The Commission's general terms of reference were as follows:

(a) to draw conclusions, make estimates, and draft measures on all matters concerning population;

(b) to submit comments on the drafts of legal orders and measures, adoption of which could have an essential effect on the future dynamics of population;

(c) to organise study of and research into population problems; and co-ordinate in a consultative capacity the work of individual institutions, institutes, and organisations.

Considering that one of the main problems, solution of which was closely linked with further growth of the population, was how to combine employment of women in social production with motherhood, the Commission made a country-wide sociological study of married women at home and at work, and took part in research into the position of women working in industry. It has been constantly concerned with problems associated with the social aspects of the dynamics of population movement—the standard of living of big families, housing conditions, the reason for the comparatively high number of divorced. Some of its proposals, put forward on the basis of these studies, evoked a positive response and have already been adopted. A very positive reception was given, for example, to the proposal to lengthen maternity leave, and to a suggested law granting women leave to stay at home until their children reached one year of age.

An important aspect of the Commission's activity was

[1] The State Commission consisted of 35 experts appointed by the government, who performed their duties on a voluntary basis without giving up their regular work. All the Commission's work was directed by a secretariat consisting of nine persons.

the educational and explanatory work carried out by its secretariat in conjunction with the mass media (press, radio, television, and cinema).

The Commission also carried out several sociological researches of a demographic character so as to clarify the effect of various aspects of life on demographic processes.

In order to extend and deepen study of population problems the Commission has now been reorganised as a Government Commission, with the Minister of Social Security and Living Standards as its vice-chairman.

Population problems were discussed at the 14th Congress of the Communist Party of Czechoslovakia, the resolution of which pointed out the need to raise family allowances for children and for young married couples.

In October 1971 a new law was adopted by which women employed in social production have the right to remain at home and look after their children to the age of two, receiving a monthly "maternal allowance" during that time, the amount of which depends on the number of children in the family, as follows: 500 korunas with one child; 800 korunas with two children; 1,200 korunas with three children.

A new stage in implementing the social programme of the 14th Congress was the joint decision of the Central Committee of the Communist Party of Czechoslovakia, the Government, and the Central Council of Trade Unions on increasing help for families with children and for newly-weds, which provided for raising family allowances for two or more children from 1 January 1973, and the granting of loans to young couples on favourable terms from 1 April 1973.

Since 1 January 1973 the scale of monthly children's allowances has been as follows: 90 korunas (unchanged) for one child: 430 korunas (previously 330) for two children; 880 korunas (previously 680) for three children; 1,280 korunas (previously 1,030) for four children.

In view of the whole importance of further study of the processes of reproduction in the country, an Institute of Demography was founded under the State Statistical Board in May 1967; one of its jobs is to carry out demographic research and analyse population dynamics.

Hungarian demographers have also stressed the need to implement an effective demographic policy based on direct and indirect use of all economic and psychological means of influence.

Some Hungarian demographers suggest moulding public opinion so as to encourage a rise in the number of births. For that purpose they propose the setting up in Hungary of a special commission, following the example of other countries, and the drawing of leading scientists into its work. One of its functions would be co-ordination of demographic policy in the country. The commission would serve as a top-level scientific consultative body. In addition, some demographers think it would be useful to organise a family protection service in the country that would wield great influence through advice on pedagogy, psychology, and public health, etc., on reducing the number of induced abortions. In order to improve the financial position of families with children, children's allowances were instituted. The ratio of the size of the allowances to the average earnings of the family, or to the average income of childless families, indicated that they can hardly be called a means of equating incomes (although family allowances were increased in 1966) (see Table 34).

Table 34

Family Allowances in Hungary

	Number of children				
	1	2	3	4	5
Family allowances in 1966 in forints	—	300	510	680	850
as a percentage of average earnings	—	17.0	28.8	38.5	48.1

In view of that, and so as to provide better help for families with children, and especially to ease the position of working mothers, the Hungarian Government issued a decree instituting benefits for the care of small children.[1] Under this decree a working woman has the right to receive benefit for the care of a child if, when her maternity leave has expired, she wishes to take further,

[1] *Demográfia*, 1967, 2:199.

unpaid leave. The scale of benefit was fixed at 600 forints (500 forints for women working in agricultural producer co-operatives). It is paid for two and a half years after the expiry of the woman's 20 weeks' maternity leave. Under existing pensions legislation such unpaid leave for working mothers counts as work service toward pension.

The introduction of benefits for the care of children gave mothers the opportunity to remain at home for the period when mother's care is considered most important for the child, and when the heaviest burden lies on the working mother.

This decree was aimed, together with other government measures, at improving aid for large families.

Research carried out by the Social Statistics Section and Demographic Research Institute of the Central Statistical Board in co-operation with the Main Social Security Board of the trade unions has shown that the instituting of these benefits has yielded certain results. Two-thirds of employed women of fertile age, who accounted for 60 per cent of all births, have been in receipt of child-care benefit. The number of women enjoying this right is growing from year to year. In 1967, the first year of the operation of this law, 61,400 women, or 72 per cent of all those eligible in industry, made use of it. András Klinger has estimated that 80,000 women were remaining at home to look after their children in 1970.[1] According to data for September 1971 this number had risen to 175,000, i.e., embraced about 10 per cent of all employed women. In the first five years of the law's operation (1967-71) a total of half a million Hungarian women had exercised their right to remain at home to care for their children.

In 1967 the number of births rose by 8 per cent, and in 1968 by another 4 per cent. That makes it possible to conclude that the benefits have had an effect in increasing natality. There is no doubt, however, that their introduction was not the sole cause of the increase; a rise in the number of births had already begun in the first half of 1967 before the benefit could yet have any effect.

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[1] Demográfia, 1966, 3.

In addition to economic means of influencing population, legal and psychological measures have been employed in Hungary, so that families would not feel that, in conditions of legalised abortion and general availability of contraception, the state was encouraging artificial prevention or interruption of pregnancy.

The conditions for permitting induced abortion were altered by decision of the Council of Ministers. Induced abortion is now only permitted by decision of a special commission, which will sanction it (a) if there are medical indications for it; (b) if the woman is unmarried or has been separated for a long time from her husband; (c) if the pregnancy is the consequence of a crime; (d) if the pregnant woman (or her husband) has not got her (or his) own flat; (e) if the woman has three living children, or has had three deliveries, or has two living children and has had an additional pregnancy; (f) if the woman is over forty. In addition to these cases the commission may sanction abortion in the following circumstances: (a) if the woman has two living children, but the health of a third would be impaired; (b) if her husband is in the army and has another six months to serve before completing his service, or is engaged on special work in the armed forces; (c) if the woman or her husband has been sentenced to imprisonment for a period not less than six months; (d) if there are convincing reasons of a social character.

Induced abortion is permitted up to the twelfth week of pregnancy, while for pregnant minors it is permitted up to the eighteenth week.

The fee for an induced abortion is 600 forints for a minor who is not earning, for women over forty, for women who have three living children, or who have had three deliveries, or who have two living children and have had an additional previous pregnancy. In all other cases the charge is 1,000 forints. In cases when abortion is indicated for medical reasons, or when the pregnancy is the consequence of a crime, or when the husband is serving in the army, or there are extenuating social reasons, the commission may waive payment.

Much is being done in Hungary to prevent unwanted pregnancies, rather than to interrupt them. In order to spread knowledge of "family planning", there are family

protection and women's consultation centres; and where there are none, advice can be obtained from the attending doctor or head of a polyclinic. Since December 1973 consultations for brides and grooms have been the rule under an order by the Ministry of Health. All couples of Hungarian citizenship wishing to marry must, if they are under 35, attend a family consultation centre and receive advice on family planning; and in case of need the rules for employing contraceptives are explained. If the couple do not produce evidence of having consulted a doctor, the Registrar's Office is forbidden to register the marriage.

The first results of the new measures were wider use of contraceptives and a fall in the number of abortions, which was not so much the result of refusal by the commission as of a reduction in the number of women applying to it.

Further measures to improve demographic policy have been proposed. In order to increase help for families with children the cash allowance paid on the birth of a child was raised from 1,100 to 2,500 forints from January 1974.

Children, as we know, are more frequently ill than adults. By an order (No. 27) having legal force, a woman or man employed in social production who is bringing up a child on her (or his) own, has the right to receive benefit for a sick child; if the child is under three years of age, such benefit is payable for 60 days in any one year; if it is under six for 30 days.

The desired changes in the reproduction regime are not always obtained by means of an active demographic policy for several reasons. Choice of the most effective means, as regards the desired result, and of the means themselves, depends on quite deep and full knowledge of the character and quantitative degree of the dependence of demographic characteristics on the whole complex of factors affecting them. At present there is not sufficient knowledge of the mechanism by which separate state measures affect the birth rate. In those countries where they are trying to raise it, for example, one of the measures adopted is financial incentives for the birth of a child. But no one can say exactly how financial aid for large families influences the decision to have another child.

There is also no answer to the problem of how to institute such a system of financial incentives as to interest all employed women, irrespective of their standard of education or level of pay, in having children. One may agree with Jean-Noël Biraben that it would apparently be best to help families in such a way as to lead to a lessening of the difference between families of ideal size for a concrete social medium and the size of family needed for extended reproduction of the population.

There is still a lack of knowledge of the stable motives of family behaviour in regard to the desired number of children. Most painstaking study of views and motives, apart from research based on official documentation, may prove very valuable in this very complex field of demography.

In order to implement an effective demographic policy it is also important to make a deeper study of such demographic factors linked with the lowering of natality as change in the age structure of the population in the separate areas of a country, as well as for the country as a whole, the frequency of marriages and births, and to analyse opinion polls on the number of children in families, and so on.

In order to get a clearer idea of the mechanism of how demographic policy affects the reproduction process, data on social psychology relating to individual, group, and mass demographic behaviour would be very important.

Demographic policy has not yet been implemented in the European socialist countries for very long, and it is still too early to speak of all its possible results and consequences at present. Further research into their experience will help towards a better analysis of the efficacy of this policy and its role as an instrument of social planning and managing society.

Chapter 6

POPULATION PROBLEMS IN DEVELOPING COUNTRIES

Y. N. Guzevaty, D. Sc. (Econ.)

Social development is a complicated and varied complex of mutually conditioned and interacting phenomena, the most important and primary of which are the economic factors making the general connections and conditionality of the phenomena necessary in character. Demographic factors also operate in this complex; and although they are ultimately secondary to the economic ones they have a certain independence and are able actively to affect social processes. It is under their influence that specific problems, "population problems", arise in various spheres of social life (economics, culture, politics, etc.).

These problems are not identical in the concrete conditions of the different countries and regions of the world. That, however, does not exclude the possibilities of scientific generalisation, which are especially important and necessary for study of the modern problems of Afro-Asian and Latin American developing countries, in which an almost similar demographic situation has built up owing to the similarity of their history and economic position.

The post-war period in the life of the peoples of Asia, Africa, and Latin America has been marked not only by great political and socio-economic changes but also by important demographic shifts expressed in a steep increase in the rate of population growth. Whereas the population of South Asia (from the Philippines to Yemen) increased by 14 per cent between 1940 and 1950,

of Africa by 16 per cent, and of Latin America by 25 per cent, the increase was already 24, 23, and 31 per cent respectively in the next decade (1950-60). In 1965-70 the mean annual growth rate was 2.8 per cent in South Asia, 2.6 per cent in Africa (including 3 per cent in North Africa), and 2.8 per cent in Latin America (including 3 per cent in the tropical zone embracing Brazil and other countries north of Argentina and Paraguay, and 3.4 per cent in the zone embracing Central American countries from Mexico to Panama). According to UN demographic publications the rates are even higher in some other developing countries.

There has been a corresponding absolute increase in the population of the developing countries.[1] Between 1950 and 1970 around 700 million extra inhabitants were added to it, i.e., as many as live in Europe (without the USSR) and North America taken together. Whereas the mean annual increase had been 15 million in 1940-50, it was already 27 million in 1950-60; and in 1965-70 it was 45 million, three-fifths of it in Central, South-East, and South Asia (India, Pakistan, Bangladesh, Iran, Afghanistan, Sri Lanka, etc.), where around 60 per cent of the total population of developing countries live.

This steep acceleration of growth rates was the result of a rapid lowering of the death rate in these countries through anti-epidemiological and other public health measures, with sustained high natality.

As the historical experience of industrial countries has indicated there will be a gradual reduction of natality, and correspondingly of natural population increase in developing countries as backward agrarian social structures are modernised. But when this process will begin and how intensely it will proceed depend on many interacting factors, including rates of industrialisation and urbanisation and the dynamics of living conditions, on progress in the fields of public education and social

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[1] This arbitrary group of countries includes the states of Asia (without the USSR, the People's Republic of China, the Mongolian People's Republic, the Korean People's Democratic Republic, the Socialist Republic of Vietnam, and Japan), all the states of Africa and Latin America (without Cuba), and Oceania (without Australia and New Zealand).

security, on the emancipation of women, and on the effectiveness of the national programmes now being adopted in many developing countries to control natality, etc. Natality will also be lowered by the effect of a further reduction in infant mortality.

One must remember, however, that the effect of economic factors on demographic processes, in particular on the dynamics of natality, is mediated through stable phenomena of a superstructural order such as marriage and family traditions and customs, religion, etc., which have great socio-psychological force in developing countries. That is why a trend toward lowering of natality does not develop automatically during economic and cultural development, or immediately, but after a certain, occasionally very considerable time lag.

Meanwhile the present high increase of population is seriously aggravating the socio-economic problems (already complex without it) inherited from the colonial past. Given the retention of a backward agrarian economy with industrialisation still weak, the working people illiterate, and mass unemployment (especially in latent form), additional human resources create additional difficulties.

To begin with, given annual population growth rates of 3 per cent, the total number of inhabitants will double in 23 years (in 17.5 years at 4 per cent). The majority of developing countries, consequently, must count on the possibility in the present demographic situation of having to build twice as "capacious" economic complexes during the next two decades or so, just in order to prevent a lowering of present living standards. As a result of intense population growth the need for expenditure on food, housing, and other vital needs for the additional people, on the education and training of the multiplying numbers of children and adolescents, and on providing jobs for the new detachments of young people reaching working age, will increase steeply. Thus the Government of India estimates that, with an annual increase of population on the average of 13 million, an additional 126,500 new schools are needed each year, 372,500 teachers, 2,500,000 new dwellings, 1,300,000 tons of food, and 4,000,000 new jobs.[1]

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[1] D. Pai. *War for Survival*, Bombay, 1971, p. 9.

In order to meet the additional consumer demand created by high population growth a considerable extension of production is required, especially of food. But the agriculture of developing countries, fettered by backward forms of land ownership and land use, has difficulty in keeping pace with their rapid demographic growth, meeting only minimal home needs. Although the total volume of agricultural production rose by 20 per cent between 1961 and 1968, the per capita index remained at the extremely low pre-war level. In 1965-68 the index of per capita food production (taking 1934-38 as 100) was 99 in South and South-East Asia, 93 in Africa, and 97 in Latin America.[1]

The food situation became particularly serious in the middle of the 1960s when production began to fall behind the accelerating population increase in some developing states (above all in South and South-East Asia where a quarter of humanity lives), because of severe crop failures; as a result, the food shortage of these countries grew considerably and their dependence on imports from the USA and other developed capitalist countries increased.

The additional food difficulties developing in these countries in the 1950s and first half of the 1960s, aggravated by the existing demographic situation, were made the excuse for a marked revival of Malthusian propaganda, in particular about the inevitable threat of world famine. Thus the American biologist Paul Ehrlich, one of the leaders of contemporary Malthusianism, published a book in 1968 under the sensational title of *The Population Bomb*, which opened with the following prophecy: "In the 1970s the world will undergo famines—hundreds of millions of people are going to starve to death in spite of any crash programs embarked upon now."[2]

Within a year of its publication, however, reality (once more!) refuted the Malthusians' doleful prophecies. The bad years of 1965-66 were followed in 1967-68 by a marked upturn in production of cereals in a number of Asian countries from the Philippines to Turkey, and

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[1] *Monthly Bulletin of Agricultural Economics and Statistics*, FAO, Rome, 1966, 7-8; 1968, 7-8.

[2] Paul R. Ehrlich. *The Population Bomb*, New York, 1968, p. 1.

(what is especially important) in such very large countrie as India.

Certain material possibilities had developed in these countries for a definite extension of tilled land, improvement of old irrigation systems and the building of new ones, increased use of chemical fertilisers, and improvement of farm implements and various equipment. The introduction of quite new high-yield and quick-ripening seed capable of giving a yield, with proper agrotechnical methods, 50 to 100 per cent higher than the customary varieties, was of great importance.

The significance of these shifts in agricultural production in the developing countries goes far beyond the limits defined simply by increase of the gross harvest of food crops. It is a new blow at the Malthusian conception of the limited character of food resources and convincing confirmation of the Marxist thesis of the unlimited possibilities of science and technology to provide humanity with the amount of food needed. The hunger and malnutrition of the populations of developing countries are the result of imperfections of social relations and not of limited natural resources.

Hence the real limits of the "green revolution" (which, although it refutes the arguments of the extreme pessimists in appraising the immediate outlook of the food situation in developing countries, nevertheless gives no grounds for inordinate optimism) are clearly visible. Unless they are backed up by a radical reconstruction of the socio-economic structure of the village and a real cultural revolution, the above-mentioned changes in farm production cannot of themselves resolve the food situation.

The "green revolution" has brought economic benefits only to the privileged, prosperous top crust of the village, which has further aggravated class differentiation in the countryside, and increased the numbers of its proletarian and semi-proletarian strata who continue, as before, to suffer from an inadequate diet. The continuance of a narrow home market as a result of low purchasing power (which cannot be raised without a real improvement of some sort in the living conditions of the broad masses) in turn remains a major obstacle to further growth of food production in developing countries,

The fact that the "green revolution" has developed in unfavourable demographic conditions has weakened its results to some extent. This can be seen in India where a record harvest of food grains was obtained in 1967-68 (95.1 million tons). In 1969-70 the harvest was even 99.5 million tons; but during those two years the population increased so significantly that the per capita level of production fell.

As regards the whole region of South and South-East Asia, the mean per capita level of agricultural production in 1969 was 15 per cent higher than in 1966 but was 3 per cent lower than in 1961. In Africa and Latin America the "green revolution" has so far (at the time of writing) only embraced the Sudan and Mexico, and to a lesser extent Kenya, Morocco, and Tunisia. As a result, the rate of population growth in these two major areas remains about level with the rate of development of agricultural production; which is why the latter still cannot surpass the pre-war level in average per capita terms.

Even more complicated problems are arising in the social development of Afro-Asian and Latin American countries from the effect of demographic factors in the sphere of labour power. High general population growth means in particular an accelerated increase in the able-bodied age group who, with lagging economic growth rates, lose the opportunity of finding jobs. The position is worsened by the fact that the rapid increase in manpower resources occurs in conditions of severe unemployment and underemployment inherited from the colonial period, conditions that, according to some estimates, affect up to a third of the economically active population of the main areas of developing countries.

Since the labour force in developing countries is being reinforced by young workers, according to UN reports, twice as fast as it is being reduced through the death of persons of working age, ageing, and other causes, new jobs are needed for almost half of the young people entering the labour market for the first time. The position will become even more complicated in the future since, according to available projections, it will be necessary to provide jobs for two-thirds of the young reinforcements after 1980. In South Asia, in particular, it is estimated that the labour force will increase from

352 million persons in 1960 to around 537 million in 1980, in Africa from 109 million to 165 million, and in Latin America from 70 million to 113 million; in other words, all three developing regions will need to provide around 300 million new jobs in the twenty years between 1960 and 1980.[1] This figure is very arbitrary, of course, but it gives a fairly correct idea of the scale of the task, which is still beyond the powers of the developing countries in spite of the fact that many of them have made definite economic progress since independence.

The new and constantly growing contingents of young people reaching working age, and the rapid growth of the labour force, are increasing the pressure of the mass of labour employed in industry on the means of production, and seriously hampering improvement of the technical equipping of labour and extension of the technical base of industry. When the national income is created in the main through increasing the volume of living labour applied, without a corresponding raising of its productivity, social expenditure on meeting the vital needs of the working people and reproduction of labour power grows. The share destined to productive consumption and increasing constant capital is correspondingly reduced.

In striving to overcome their economic backwardness more and more developing countries are industrialising by building modern undertakings and industries equipped with the latest machinery with a relatively low need for labour power. This is leading to further aggravation of the employment problem, to the formation of extensive static surplus population in "traditional" spheres of the economy, and to splitting of the latter into two extremely uneven and unequal parts, viz., a narrow, relatively rapidly progressing, prospering modern sector and the remaining stagnating part.

In this connection one must touch specially on the problem of providing jobs in the countryside, where the majority of the new reinforcements of the labour force continue to reside because of the incapacity of other branches of the economy to provide employment for them. Although the share of the labour force engaged in agriculture will seemingly gradually fall, its absolute growth

[1] *Labour Force Projections 1965-1985*, ILO, Geneva, 1971, pp. 19-21, 66-68.

will remain high. And when one allows for the simultaneous increase in rural localities in the number of dependents in peasant families and other persons not actively engaged economically, for whom farming also serves as the main source of existence, one may say without hesitation that the majority of developing countries will retain an overwhelmingly agrarian economic structure to the end of the century.

The mounting labour surplus of the countryside resulting from the rapid increase and low mobility of population will not only retard the raising of labour productivity but will even have a negative effect on all aspects of socio-economic development. In particular it will encourage preservation in the countryside of survivals of backward relations of production, above all survivals of subsistence economy with its low living standards and weak purchasing power.

To that one may add that the increasing growth of rural population, most of which consists of peasants with very little or no land, is making the agrarian surplus population characteristic of developing countries even worse and is thus an important additional cause of increased migration of peasants to the town, which in turn is aggravating the economic and social problems of urbanisation to the limit.

Without going into the position of the landless peasant, the partition of poor peasant holdings among multiplying heirs is, as it is, accelerating the parcelling up of arable land, increasing the dependence of the peasant family budget on subsidiary earnings, and pushing workers not finding application for their labour out of the village irrespective of the demand for labour in the non-agricultural sectors of the economy. Only a small fraction of the rural migrants is therefore drawn into the ranks of the industrial workers, and the towns are overcrowded with inhabitants for whose presence there are no economic conditions needed. As a result, open and latent unemployment (the latter especially in the form of an incredibly inflated services sphere) increases, slum districts grow as a consequence of the aggravated housing crisis, and there is continuous reinforcement of the stratum of the lumpen-proletariat with its social vices.

Modern industry everywhere requires a trained labour force with a certain standard of education and the necessary skills and work habits. But because of the cultural backwardness inherited from colonial times, manpower reserves are mainly reproduced in developing countries through an increase of uneducated workers without vocational or trade training, which becomes a serious obstacle, along with the general surplus of cheap labour, to growth of labour productivity. In order to modernise their economies, and in order to speed up scientific and technical advance, it is consequently necessary to have a corresponding development of modern science and a modern system of public education. In this field the developing countries have made notable progress since independence, but the unresolved tasks and uncertain difficulties are still very considerable, in particular because of accelerated population growth.

With high natality, reduced infant mortality leads to the intake of children of school age becoming bigger and bigger every year. It is expected that the mean annual rate of increase in this decade (1970-80) will be 2.5 per cent in Asia, 2.7 per cent in Africa, and 3 per cent in Latin America, as a result of which the total number of children of school age (5 to 14) will have risen to 822 million in 1980, i.e., increased by 184 million or 28.5 per cent compared with 1970.

The additional need for teachers, and for school premises, equipment, and textbooks, is growing at a corresponding rate. Since the education authorities of developing countries are often unable to meet these needs, the organisation of teaching runs into major difficulties, and in many countries the date for introducing universal compulsory schooling is postponed further and further. Thus there are estimates that 74 million children of school age in South and East Asia will still not be studying in 1980 because of the high natural increase of population, including 15 million in the 6-12 age group and 59 million in the 13-15 group, although the total number of schoolchildren will increase by almost three times as compared to what it was in 1962.

High natural increase is reducing the effect of measures to eliminate adult illiteracy. Although the percentage of the illiterate is being gradually lowered, their abso-

lute numbers in developing countries rose (according to UN data) from 700 million persons in 1960 to more than 800 million in 1970. The actual position is even worse, since many of those who are counted in the statistics as "having overcome their illiteracy" by means of short courses may, because of the still existing general cultural backwardness, forget how to read and write after a brief period.

Thus, in the sphere of education, as in those of employment, food consumption, urbanisation, and other spheres of the social life of developing countries, high population growth creates certain economic difficulties that ultimately build up to the still inadequate rates of economic development. In other words, population problems are an aspect of their general economic, social, and cultural problems inherited from the colonial past. It is not the demographic processes themselves that engender hunger, poverty, and unemployment of the working masses, but quite concrete, historically determined social conditions. The present demographic changes are only aggravating these problems. Their solution cannot be simple but calls for a complex, all-round approach.

Chapter 7

"FAMILY PLANNING" PROGRAMMES IN DEVELOPING COUNTRIES

Y. N. Guzevaty, D. Sc. (Econ.)

The complex problems being created by rapid population growth in conditions of economic backwardness have prompted an ever growing number of governments in developing countries to include in their general complex of economic measures a special policy aimed at slowing it down by various means directed to a gradual lowering of their high natality. In particular they are employing legislative measures like the banning of early marriage and the sanctioning of abortion, but mainly are relying on wide propaganda for few children as the ideal and on extending the activity of the state health authorities in acquainting the public with methods of deliberate family planning of the number of children desired and in making the medicaments and medical appliances needed for birth control available.

In 1973 the governments of 28 countries with more than 70 per cent of the population of the developing world had adopted these measures as their official programmes. In another 26 countries similar measures were being employed with government support but without official sanction.

The first developing country to begin to implement a national programme of "family planning" as state policy

was India, as early as 1951.[1] Later, especially after 1960, a demographic policy was officially adopted in Pakistan, Sri Lanka, Singapore, Malaysia, Nepal, Indonesia, Thailand, the Philippines, Turkey, Iran, Tunisia, Morocco, Ghana, Kenya, and other countries. Despite the resistance of the Roman Catholic Church propaganda for deliberate limitation of the desirable number of children has spread increasingly in Latin American countries, including the Dominican Republic, Colombia, Puerto Rico, Barbados, Trinidad and Tobago, and Jamaica. In Oceania an official "family planning" programme has been adopted by the Government of Fiji.

Thus a demographic policy aimed at limited natality has become a marked phenomenon in the life of developing countries, the more so since the problem of its social expediency continues to be a subject of scientific dispute and ideological confrontation.

The adherents of the Malthusian conception hold the view that demographic factors are the main cause of the economic and social difficulties being experienced by developing countries. Hence the reactionary conclusion is drawn that the main way to overcome them can only be measures to control natality. Typical of that position is the assertion that population limitation is the preliminary condition for any radical improvement of the human condition. Imperialist propaganda employs this anti-scientific conception in order to divert public attention from the real facts, which indicate that it is imperialism and its colonial and neo-colonial exploitation that condemn the peoples of Afro-Asian and Latin American countries to economic and cultural backwardness, given which high population growth has grave consequences. Home reaction in these countries in turn resorts to Malthusian arguments in order to disorganise and weaken the struggle of the working people for democratisation of public life and the carrying out of radical socio-economic reforms.

In discussions on birth control another point of view is met, the adherents of which refuse in general to recognise that the accelerated growth of population in

[1] Vigorous implementation of demographic policy on a national scale actually began in India in October 1963, when a revised and extended variant of the official "family planning" programme was put into operation.

developing countries is creating certain specific problems. They look upon the increase of human resources solely as a positive factor promoting socio-economic development in any conditions, since people are the main productive force of society; and they deny any need for measures to control natality, unconditionally condemning them as an expression of Malthusian policy. Such an attitude stems from underestimation of the definite independence of demographic factors, and an ignoring of the important dialectical proposition that demographic factors, although secondary and dependent in relation to social production, may and do exert an active reverse action on economic and social processes.

The striving of the governments of developing countries to include measures directed at controlling reproduction in their general programmes of economic development is quite justified in principle. It is impossible to plan economic development in any way successfully without allowing for the demographic factors and without trying to affect them in order to obtain the optimum combination of population growth and economic progress. Since a tendency for natality to fall regularly develops in the course of economic and cultural construction, there is every justification for trying to accelerate development of this trend by means of a purposive demographic policy. In other words, measures to limit natality may yield definite results and be useful in mitigating economic difficulties if their implementation is based on general socio-economic and cultural changes. In the opposite case they could prove unsuccessful, since no propaganda for family planning will be able to achieve any significant target in traditional, stagnant social conditions unaffected by new ideas, lacking perspectives, not making any real changes in life, and consequently not experiencing any need to change customs in the field of family relations.

National liberation revolutions and the other political and social upheavals associated with them have aroused the peoples of developing countries and brought them into play; and along with other social changes they have accelerated the processes of urbanisation, which are expressed in changes in the psychology of the rural population as well as in growth of the population of cities.

industrial construction, the new outlooks opening up before the youth in connection with the spread of education, and the drawing of women into social production and political life are all gradually altering attitudes to traditions of having many children, and that is creating certain opportunities for measures to control natality.

In the 1960s the first signs of a reduction of natality had already appeared in several developing countries. Thus the general birth rate had fallen as follows in 1972: in Western Malaysia from 46.2 births on average per 1,000 inhabitants in 1957 to 37.0; in Puerto Rico from 34.8 in 1956 to 25.0; in Tunisia from 49.6 in 1961 to 42.0; in Sri Lanka from 36.6 in 1960 to 31.0.[1] A decline in the birth rate has also occurred in several other developing countries.

It must be stated here and now that these demographic changes cannot be attributed simply to measures to limit natality. In Sri Lanka, for example, one of the main causes was the raising of the marriage age for women and a corresponding drop in the marriage rate; and in Puerto Rico it was due to the heavy emigration of youth, and so on. But the reduction in marriage productivity in recent years is also acquiring growing significance and it is clear that "family planning" programmes are playing a certain role in it. As the demographic experience of the Soviet Central Asian republics has very clearly shown, even without a special policy aimed at accelerating changes in the traditional standard families of many children, the most radical socio-economic changes do not lead to an immediate lowering of high natality.

It is rather easier, of course, in small, comparatively developed countries, to achieve success in carrying out a demographic policy than in, say, such a big country as India. But even in India, where the general birth rate remained steady around 41 per 1,000 over the two decades ending in 1965-66, a fall to 39 in 1969 and to 37 in 1971 was first noted (according to official estimates), including a fall to 38.8 in rural localities and to 29.7 in urban areas. In three states (Kerala, Tamil Nadu, and

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[1] *Demographic Yearbook 1965*, New York, 1966, p. 43; *Demographic Yearbook 1970*, New York, 1971, p. 120; 1972 *World Population Data Sheet*, Population Reference Bureau, Washington.

Maharashtra) with a total population of 113 million (1971), natality was below 32 per 1,000.[1]

The first results of implementing family planning programmes in developing countries are already making themselves felt; and in the not so distant future they will probably do so even more. Nevertheless, they do not justify the excessively optimistic estimates that appear from time to time in the Western press and little by little are imposing on readers the already known false thesis of the paramount importance of controlling natality in order to solve socio-economic problems in developing countries.

One author of these enthusiastic estimates is Dr. D. J. Bogue of the University of Chicago, who himself described his position as the most optimistic. He stated that instead of being threatened by the "population explosion" the world was on the threshold of a contraceptives explosion. That was why, starting with 1965, the world population increment would decrease with every passing year, so much so that by 2000 it would approach the zero level, so that, except in isolated and small retarded areas, the growth of population would not be regarded as the principal social problem.

Matters are not so simple, it goes without saying, as the author of the above estimates supposed. We must not forget that although official "family planning" programmes apply to 70 per cent of the population of developing countries, they are still largely (at the time of writing) formal. In addition, even in those countries where propaganda for "family planning" is quite widely and vigorously carried on, application of its recommendations in practice is inevitably delayed, and is limited at first, since new economic stimuli encouraging people to control natality consciously do not arise immediately in the course of economic construction, or everywhere, and only gradually embrace individual social and territorial groups of the population.

We must bear in mind, moreover, that even the most successful policy of limiting natality cannot yield im-

[1] *Sample Registration of Births-Deaths in India: Rural 1965-68*, Vital Statistics Division, Office of the Registrar-General, New Delhi, 1970, p. 22; *Sample Registration Bulletin*, 1971, 2 (Oct.-Dec.):1; *The Statesman*, Calcutta, 5 May 1972, p. 5.

mediate economic effect on a national scale because the great numbers of children to be fed, clothed, and provided with schools in six to eight years' time, and with work in 15 to 17 years, have already been born, or will be soon. Today's efforts at limiting natality will therefore not begin to have any noticeable effect in the economic field, and in particular on the problem of employment, earlier than twenty or thirty years from now, i.e., at the end of the century.

But it would be wrong to reduce the whole significance of "family planning" programmes in developing countries simply to one demographo-economic aspect of the matter. As a rule, they form an important integral part of a system of state measures to protect the health of mothers and children (direction of the programmes usually lies with Ministries of Health), and in this field they can immediately produce very useful results conducive to lowering the still very high maternal and infant mortality because of too early marriage, too frequent and numerous deliveries, unqualified abortions, and so on.

Lenin, in his day, numbered freedom for medical propaganda of knowledge about contraceptives among the "elementary democratic rights of citizens, men and women" and emphasised that Marxists' hostility to Neomalthusianism must not prevent them demanding "the unconditional annulment of all laws against abortions or against the distribution of medical literature on contraceptive measures, etc."[1]

Thus, with the existing tradition of having many children in society, "family planning" programmes present parents with the opportunity, even if they do not intend to limit the number of children desired, to "space" births out and to postpone them to a time convenient for the family. As the economic factors stimulating limitation of natality grow stronger, the programmes, with their broad propaganda of medical knowledge and distribution of the requisite means for "planning the family", will create the conditions for faster promotion in society of the ideals of a family with few children, and speed up the emerging tendencies for natality to fall.

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[1] V. I. Lenin. The Working Class and Neomalthusianism, *Collected Works*, Vol. 19, p. 237.

Measures to control natality, given high population growth and economic and cultural backwardness, can only be expedient in a whole complex of state measures, and only as a means of mitigating certain socio-economic problems, and in no way as a means of solving them completely. No lowering of natality, therefore, can free developing countries from the necessity to work energetically to improve public education, carry out agrarian reform, modernise farming, and industrialise, since the only way to solve their population problems lies in maximum mobilisation of all their forces for a radical reconstruction of their economies and cultures.

Chapter 8

WARS AND POPULATION

E. A. Arab-Ogly, Cand. Sc. (Philos.)

During the first half of this century the peoples living on the present territory of the Soviet Union suffered a whole series of exceptionally hard, long, and bloody wars: the Russo-Japanese War of 1904-05, the First World War of 1914-18, the Civil War of 1918-21, the Patriotic War of 1941-45, and other lesser armed clashes and conflicts. These wars were accompanied with extremely heavy human casualties as well as with immense economic damage and destruction of property.

During World War I the Russian Army alone lost nearly two million men killed. As a result of World War II more than twenty million persons were killed or died in the USSR, i.e., 10 per cent of the population. These figures do not include so-called indirect war losses through the increase in mortality and sharp decline in natality compared with the pre-war period, or the loss of population through migration. Wars reduced the USSR's population and affected its structure as regards both its age composition and sex.

The problem of the demographic consequences of war, however, and in particular of the wars in which the Soviet Union was involved, has not yet been adequately studied; but many of the economic difficulties and social problems with which researchers have had to cope, and are still having to deal, are connected with them in one way or another.

Throughout history wars have been a terrible calamity for nations, and for the toiling majority of humanity forced to pay for the adventurist foreign policy of the ruling classes. Instead of the "promised peace on earth" proclaimed by the ideologists of the rising bourgeoisie, capitalism brought with it even bloodier armed conflicts. War's toll in blood rose century by century and was converted in the age of imperialism into systematic extermination of peoples in the name of the nationalist and racialist "myths of the twentieth century", and for the sake of the vested interests of a handful of monopolists.

As capitalism developed it was the masses of the people above all who were forced to pay for the aggressive policy of the ruling classes. For several centuries war casualties among soldiers rose continually while the proportion of killed and wounded officers among the total casualties of the armies of capitalist countries was more than halved, and that among generals was reduced by a factor of several dozens.

Determination of the social composition of war casualties poses a difficult task for demographers; nevertheless, even the fragmentary data at our disposal allow us to detect several patterns.

During capitalism's development there have been at least three qualitative changes in the character of military conflicts, each of which was accompanied with a significant increase (by several times) in casualties and a steep rise in its negative demographic consequences. The first of these changes was the transition during the nineteenth century from relatively small professional armies to modern mass ones, which led to war becoming a main factor in uneven sex distribution of the population. The second change was the transformation of local wars in the twentieth century into world wars of many years' duration, which also brought with them grave disproportions in the age structure of the population. Finally, the third change was the perfecting of war materiel, which converted whole countries and continents into the theatre of military operations, so that the casualties among the civilian population equalled and often even exceeded those of the army. With the invention of atomic and thermonuclear weapons wars have begun to threaten the physical extermination of nations.

In these conditions the demand for peace and striving for social equality have become the main incentive drawing the masses of the people into struggle for a revolutionary transformation of society along different, socialist lines. Historical experience at the price of immense sacrifices and sufferings is convincing humanity of the justness of Marx's and Engels' assertion that, with the disappearance of antagonistic classes within nations, hostile relations between nations would also disappear.

However great the losses among the armed forces and civilian population, they are nevertheless not the only demographic consequences of war.

To direct war losses there must also be added the "indirect" ones caused by the reduction of natality and increase in mortality, the deaths of civilians from exhaustion and the various deprivations caused by war, during evacuation and other displacement, and from famine and epidemics, which may continue for some time after the ending of military operations. These indirect war losses considerably exceed war casualties proper, occasionally by several times, although they are passed over in silence in the official statistics (see Table 35).

Table 35

Direct and Indirect Population Losses during World War II

Losses	Countries			
	Germany	France	Japan	Poland
All losses (in millions)	11	2	5.5	6
Including (as percentages)				
direct casualties in the armed forces	28.4	7.5	38.2	2
deaths of civilians	6.2	17.5	16.4	98
increased mortality	43.2	30.0	23.6	
reduced natality	22.2	45.0	21.8	

Sources:
Itogi vtoroi mirovoi voiny (Consequences of World War II), Moscow, 1957, pp. 594-95; I. B. Taeuber. *The Population of Japan*, Princeton, 1958, pp. 334, 352.

Behind the relatively small number of killed in action there are often hidden very heavy indirect war casualties. In World War II, for example, the French Army lost only 150,000 men killed or dying of wounds. While the total war casualties of France, direct and indirect, exceeded two million.

Wars are not only accompanied with a quantitative reduction of population through direct and indirect war losses but also bring with them a serious disproportion in its age and sex distribution. These changes in the structure of the population show up quite clearly when comparing the sex and age pyramids of belligerent and neutral countries (see Fig. 2).

The figure clearly brings out the following long-term demographic consequences of wars:

Comparable sex-age pyramids of the population of Sweden (outline), the German Democratic Republic and the Federal Republic of Germany (shaded)

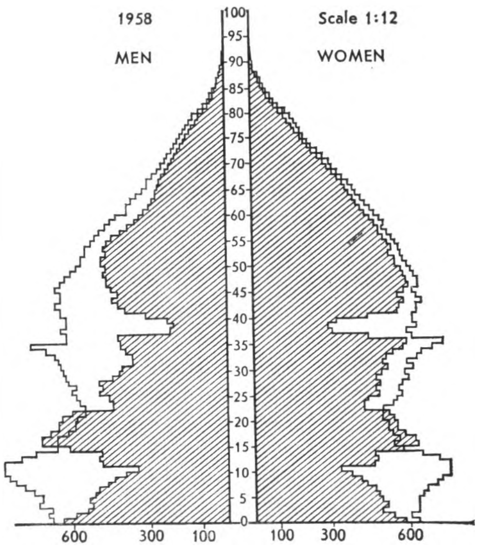

Fig. 2

Compiled by the author on the basis of *Statistisches Jahrbuch der Deutschen Demokratischen Republik* 1959; *Statistisches Jahrbuch für die Bundesrepublik Deutschland* 1959; *Statistisk Arsbok för Sverige* 1959.

(1) a great reduction of population in all age groups, amounting to 18 to 20 million persons, or 20 to 22 per cent of the population that would have been expected in peaceful conditions;
(2) the general increase in mortality and shortening of average life span as a consequence of undermining of people's health, especially that of men, among whom there are many war invalids;
(3) the considerable numerical preponderance of women over men in adult and advanced age groups, mainly owing to direct losses in the two world wars;
(4) disturbance of the natural process of the replacement of generations and the marked inequality in the distribution of population by separate age groups.

The changes in structure caused by war bring with them extremely negative economic and social consequences, often considerably more serious and long-lasting than the loss of population alone.

In the first place manpower reserves are reduced, especially in the most productive and able-bodied age groups, which essentially retards restoration and economic development. In addition, a greater burden of expenditure to support children and the old is thrown onto the shoulders of the working population than in non-belligerent countries.

The considerable preponderance of women over men in the mature age groups leads to many women in general being unable to marry or raise a family and having to live single all their lives. Without going into the negative moral and psychological consequences of that, it is accompanied with a lowering of natality, growth in the numbers of divorces and of children of unmarried mothers, and also of children brought up without a father, and encourages a certain moral licentiousness and increase in juvenile delinquency. The preponderance of women also explains to some extent their being widely drawn into so-called men's occupations.

The fall in natality in war years, and consequently the very uneven distribution of children by year of birth initially causes certain difficulties in their upbringing and education, and then 15 to 18 years after the war a steep drop in the inflow of new manpower into the economy; at the same time there are also difficulties in

providing the intake for higher educational institutions, and so on.

Finally, when the fall in natality in war years has been steep and prolonged, it may lead 20 to 25 years later to a secondary drop, though not so pronounced, with cyclic recurrence of the consequences mentioned above, though in attenuated form.

Thus the demographic consequences of the two world wars, the uneven age and sex distribution of the population, will retain their effect to the end of this century; the secondary fall in natality in 1960-70 will probably make itself felt right up to the beginning of the twenty-first century.

The timely adoption of state measures (allowances for large families, protection of the interests of mother and child, extension of the network of children's institutions, encouragement of marriage, improvement of the system of health services and social security, and so on) can, as the successful experience of the Soviet Union and of several other socialist countries, and also of France has demonstrated, mitigate some of the demographic consequences of war, and in particular speed up replacement of the quantitative loss of population, and restore its natural increase. But such measures are powerless to eliminate the already established ratio between the sexes and age groups of the existing population.

How catastrophic war's demographic consequences can be for the development of a country is shown clearly by France. It used to be common to explain the continuous fall in growth of France's population over a century and a half, and the reduction of its weight in the population of Europe caused by that, primarily by such causes as the preponderance of petty proprietors not wanting to divide up the inheritance, the preference shown for *rentes* over other forms of investment, late marriage, and so on. But, while not denying the significance of those socio-economic factors, the slow growth rates of France's population and economic development must also be attributed to its huge war losses during the last century. The investment of capital in *rentes*, moreover, was dictated in many ways by people's striving to provide for their old age in case of their sons' being lost in war. That in turn led to a constant outflow of capital abroad in the

form of foreign loans, continuous devaluation of the franc, and so on. It is no accident that such an authority on problems of demography as Alfred Sauvy considered the slowing down of population growth as one of the main causes leading to France's gradual loss of her economic and political position in Europe.

The vast direct and indirect losses of World War II would, in the unanimous opinion of demographers, have made rapid economic restoration and development impossible in the Federal Republic of Germany had they not been compensated by the resettlement on its territory of millions of workers from Italy, Spain, Greece, Turkey, and other countries.

The Soviet Union suffered immense human losses as a result of the two world wars and civil war, losses incomparably greater in relation to the population than, say, France's losses in the 1914-18 war. Any capitalist country in a similar situation would have sunk into demographic and economic stagnation for decades, as the example of France between the wars shows. The advantages of the socialist social system and of planned development of the whole economy enabled the Soviet Union and other socialist countries in Europe to take a whole number of prompt legislative and economic measures, which is why on the whole they overcame the consequences of the war, including the demographic ones, much more rapidly than the capitalist countries, although the direct and indirect war losses of the latter were much less than theirs.

It took the Soviet Union about six years to make good the loss of population caused by the First World War and the Civil War, and around ten years to make good the losses of World War II, while France, in spite of considerable immigration (around two million during 1919-39) had not been able to regain the 1914 level of population by World War II.

The consequences of these bloody wars, nevertheless, told on the Soviet Union, which had always been distinguished by high natural increase. From the data of all peace-time years one may conclude that if there had been no war its population would now have reached some 350 million.

The demographic consequences of wars for the Soviet Union, however, are far from exhausted simply by the

difference between the possible and actual population of the country. Whereas the size of its population on the eve of the Great Patriotic War had been topped by 1956, that of the Ukraine only in 1958, of Latvia in 1964, and of Byelorussia in 1970; and in some regions of the European part of the RSFSR the pre-war level of population has not yet been reached (at the time of writing). It is not precluded, also, that these demographic consequences of the Great Patriotic War affected post-war urbanisation and hampered migration from the European part of the country to the East and the opening up of Siberia's natural resources in the post-war years.

The changes in the sex and age structure of the population were even more serious and protracted. The war caused a disproportion between men and women while the decline in natality in the war years seriously disturbed the replacement of generations.

One must also largely attribute such a phenomenon as the variation in the intake of pupils in general schools to the demographic consequences of the war for the USSR. Thus the number of pupils in the first four classes was 21,700,000 in 1940/1, 20,100,000 in 1950/1, 12,700,000 in 1954/5, 13,600,000 in 1955/6, 15,580,000 in 1956/7, 17,800,000 in 1958/9, and 21,300,000 in 1968/9.

Finally the decline in natality in the Soviet Union during the 1960s from 25 to 17 per 1,000 of the population was also largely due to the fact that men and women born in the war years began to reach marrying age then.

The problem of the demographic consequences of wars provides a theme for the most brazen speculation by reactionary politicians and ideologists, who try to gloss over the figures of direct war casualties and pass over in silence the indirect war losses and their disastrous effect on economic and social advance, so as to reconcile the people of their own countries both to the aggressive foreign policy of the past and to the prospect of new military conflicts.

The cynical justification by Neomalthusians (like Gaston Bouthoul) of hecatombs of human victims on the altar of the capitalist Moloch as the panacea for alleged overpopulation of the Earth is only one of the more disgusting forms of this kind of demagogy. But alongside it there are other, more subtle, and therefore more dangerous forms of demagogy.

Thus the exponents of local wars like those that have been waged in Korea and Vietnam and in the Arab East demagogically plead that the annual casualties involved will not exceed, say, the total figure of the victims of road accidents. Let us leave the logical paradox to their India-rubber consciences: how can decent regret for the death of people in accidents serve as justification for the deliberate killing of the same number of people (and in fact always more!)?

Humanity's conscience and reason cannot be reconciled to the possibility of a new world war. From the demographic aspect alone the calculations of periods "of economic recuperation of the United States" made by Herman Kahn in his book *On Thermonuclear War* are quite naive; and so are all his subsequent calculations (see Table 36).

Table 36

Tragic but Distinguishable Post-War States

Dead	Period of economic recuperation	Survivors	Date when the USA had such a population
2,000,000	1 year	180,000,000	1960
5,000,000	2 years	177,000,000	1959
10,000,000	5 years	172,000,000	1957
20,000,000	10 years	162,000,000	1953
40,000,000	20 years	142,000,000	1946
80,000,000	50 years	102,000,000	1916
160,000,000	100 years	22,000,000	1849

Sources:
H. Kahn, *On Thermonuclear War*, London, 1960, p. 20; *Statistical Abstract of the U.S.*, New York, 1961, p. 5.

Kahn's figures will not stand up to any critical demographic or sociological analysis whatsoever. The two last columns that we have added to his table show that his forecasts had no other foundation in fact than primitive calculations, namely, during what time in the past the US population increased by a figure taken by him as hypothetic losses if we take the number of survivors as the starting figure. He ignored the fact that the population on which he based his calculations had a natural structure and had grown, in addition, through consi-

derable immigration. The population surviving a thermonuclear war would suffer the effect of radioactive fallout and would have a marked abnormal age and sex structure. And then extremely sharp changes in the ratio of urban and rural population and many other disproportions would have to be added to that. Such a population could obviously not have a natural increase characteristic of the United States in the past. It would also not be in a position to rebuild the country's economy from the ashes and to restore pre-war living standards for the simple reason that the modern diversified economy of the United States requires a corresponding labour force and assumes mass consumption. The production of goods like motor cars, refrigerators, television sets, etc., that the "average American" owns, is only profitable when they are made by the million. The transport communications existing now in the United States would prove an exhausting burden for a population half the size, and so on.

That is why Kahn's assertion that the United States, if it followed his advance, could come out of a thermonuclear war not only the richest country in the world but also one of the biggest, was and is quite unsound. It is a dangerous illusion both for the United States and for humanity. The American sociologists Dentler and Cutright, polemicising with Kahn, convincingly revealed the unsatisfactory character of his statistical calculations, and also showed that the socio-economic system existing in the United States would be unable to survive a thermonuclear war.[1] All such calculations as Kahn's are not only inhuman, but are also short-sighted, irresponsible, and in fact absolutely unsound and bankrupt.

Any attempt to gloss over the demographic consequences of thermonuclear war must evoke sharp criticism. An example of such statistical tricks is David Heer's book *After Nuclear Attack*,[2] in which colossal human casualties are "transformed" (by juggling with relative figures) into insignificant changes of tenths and hundredths

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[1] Robert A. Dentler and Phillips Cutright. Social Effects of Nuclear War. In: *Essays in Social Science and Social Theory in Honor of C. Wright Mills*, ed. by J. L. Horowitz, Oxford University Press, New York, 1964, pp. 409-26.

[2] David M. Heer, *After Nuclear Attack. A Demographic Inquiry*, New York, 1965.

of 1 per cent in the ratio of the various socio-professional groups of the populations. But Heer's main and intentional "statistical miscalculation" is that he takes 30 per cent of the US population as the "upper limit" of losses in a thermonuclear war; yet even spokesmen of the Pentagon officially admit the possibility of 60 to 80 per cent of the population being killed.

A third world war, wiping out the industrial and cultural centres of world civilisation and threatening the very existence of mankind would not help solve the difficulties existing in any one country but would only aggravate them and engender a mass of new problems. Thermonuclear war, which is senseless as a solution of the international disputes and political conflicts of our time, would also be a policy of suicide from a demographic point of view.

In these conditions, the peoples of all countries, while not allowing themselves to be intimidated by war or sacrificing their freedom and future for peace, are increasingly aware that prevention of a new world war is in their interests and within their power. Only the struggle of the oppressed peoples for independence, relying on the active support of all peace-loving forces, can block the escalation of "limited" war into world war; only the destruction of stocks of atomic and hydrogen bombs and the closing down and withdrawal of military bases on foreign soil can save humanity from the danger of accidental outbreak of thermonuclear war; only universal and complete disarmament will guarantee firm and lasting peace on earth.

The Soviet Union is doing everything possible to prevent a new world war and to eliminate the danger of extermination of the human race through a nuclear catastrophe.

In today's conditions there is no alternative to peaceful coexistence of countries with different social systems and to relaxation of international tension. The Peace Programme adopted by the 24th Congress of the CPSU, which corresponds to the vital interests of all nations, has therefore received broad support throughout the world; and that has made it possible to achieve important changes in the whole international situation in spite of the resistance of reactionary imperialist forces.

Thanks to the consistent and peaceful foreign policy of the Soviet Union there has been a real shift in recent years in the matter of normalising international relations. The signing and subsequent ratification of state treaties between the Federal Republic of Germany and the USSR, and between the Federal Republic of Germany and Poland and Czechoslovakia, has contributed much to this. The realistically-minded statesmen of the Western powers are increasingly conscious of the hopelessness of the policy of cold war and nuclear arms race. A major contribution to improving the international situation was the agreements signed by the Soviet Union in the 1970s with France and the United States. In the Basic Principles of Mutual Relations between the Union of Soviet Socialist Republics and the United States of America, signed in May 1972, it was stressed in particular that both parties "will proceed from the common determination that in the nuclear age there is no alternative to conducting their mutual relations on the basis of peaceful coexistence".[1]

The Conference on Security and Co-operation in Europe held in Helsinki in 1975 was highly important for the whole world, as well as for Europe. The Final Act signed there affirmed the inviolability of state frontiers, normalised relations between all countries irrespective of their social systems, and opened up favourable prospects for economic, scientific, technical, and cultural co-operation between them.

Many of the historical tasks set out in the Peace Programme have already been accomplished or are in the course of resolution, a fact that made it possible for the 25th Congress of the CPSU to outline a further programme of struggle for peace and international co-operation, freedom and the independence of nations. The guaranteeing of stable peace, freedom, independence, and security for all nations calls for making détente, or the relaxation of tension, an irreversible process, and for extending it to the whole world. It is vital for political détente to be supplemented by military détente. And that dictates a need for consistently making the transition from limitation of the strategic arms of the Great Powers to their

[1] *New Times*, 1972, 27:39.

reduction, to banning of the development of new types of weapons of mass destruction, and finally to universal and complete disarmament and the elimination of all remaining hotbeds of war and survivals of colonialism. Speaking at the 25th CPSU Congress, Leonid Brezhnev with full justification emphasised: "In the eyes of the peoples of the whole world, the Land of Soviets is by right regarded as the bulwark, the standard-bearer of peace. We have done and will continue to do all we can to safeguard and consolidate peace, and to rid mankind of new destructive wars!"[1]

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[1] *Documents and Resolutions. XXV Congress of the CPSU*, pp. 105-06.

Section Six

BOURGEOIS POPULATION THEORIES

Chapter 1

THE EVOLUTION OF MALTHUSIANISM

B. Y. Smulevich, D. Sc. (Med.)

Malthus' doctrine is the traditional theory of the bourgeoisie depicting the unemployment and poverty of the masses as the inevitable consequences of natural laws. In his *Essay on the Principle of Population* Malthus advanced the proposition that "population, when unchecked, goes on doubling itself every twenty-five years, or increases in a geometrical ratio",[1] while "the means of subsistence under the circumstances favourable to human industry, could not possibly be made to increase faster than in an arithmetical ratio".[2] His law operated, he wrote, "in every age and in every state in which man has existed or does now exist".[3] Accordingly Malthus laid the blame for unemployment, poverty, etc., on the labourers themselves. "The principal and most permanent cause of poverty," he wrote, "has little or no *direct* relation to forms of government, or the unequal division of property; and ... as the rich do not in reality possess the *power* of finding employment and maintenance for the poor, the poor cannot, in the nature of things, possess the *right* to demand them."[4] Malthus candidly declared that inculcation of this outlook among the people was the

[1] T. R. Malthus. *An Essay on the Principle of Population*, London, 1890, p. 4.
[2] *Ibid.*, p. 6.
[3] *Ibid.*, p. 295.
[4] *Ibid.*, p. 541.

aim of his "truths" and expressed the "hope" that "every man in the lower classes of society, who became acquainted with these truths, would be disposed to bear the distresses in which he might be involved with more patience; would feel less discontent and irritation at the government and the higher classes of society, on account of his poverty; would be on all occasions less disposed to insubordination and turbulence...".[1]

A switching of attention from the socio-economic factors in poverty and unemployment to the problem of population growth is thus the essence of Malthusianism, as the founders of Marxism-Leninism and many progressive scientists have shown. Malthusianism, however, has always reacted promptly to changes in world population growth rates and in those of separate countries, but even so it has constantly stressed and stresses that the character of socio-economic development is determined by the various rates of population growth.

It is therefore no accident that during the crisis of 1929-31, when there was a steep drop in natality in capitalist countries, L. Hersh, a worker in the League of Nations International Labour Office, formulated an idea of Malthusianism "inside out" that attributed the cause of the growth of unemployment and poverty to too low natality and decline in demand arising from it. In the age of imperialism Malthusianism has been widely employed as a "justification" of aggression, colonialism, and neocolonialism. It was employed in the ideological preparation of the World War II; the reactionary rulers of Italy and Japan "motivated" aggression, in particular, by "overpopulation" caused by high natality, and the German fascists by "dying out" and depopulation through lack of "living space" (*Lebensraum*).

After the war many books appeared in the United States and other capitalist countries propagandising the crudest misanthropic Malthusian ideas.

The powerful movement for peace, the peace policy of the socialist countries, the statements of many progressive scientists in capitalist countries against Malthusianism's aggressive conceptions, forced reactionary ideologists to be particularly "flexible". Vogt's "evolution" is clear

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[1] *Ibid.*, p. 542.

evidence of this. After his openly misanthropic *Road to Survival* he published *People! Challenge to Survival* in 1960, in which he complained that *Road to Survival* had been assessed as fascist. He tried to convince the public that he had been misunderstood; and now, while still holding the same Malthusian position, he expressed himself more circumspectly.

A special situation arose after World War II in connection with the "population explosion", i.e., the rapid acceleration of population growth. As the English biologist Anthony Barnett correctly noted, Malthusian ideas, as before, are serving vested economic and political interests. In addition, however, many people are becoming Malthusians under the overwhelming impact of rapid population growth. Bertrand Russell, the well-known champion of peace, wrote for example in the introduction to a symposium on the population crisis, that "the world is faced at the present day with two antithetical dangers. There is the risk which has begun to sink into popular consciousness, that the human race may put an end to itself by a too lavish use of H-bombs. There is an opposite risk, not nearly so widely appreciated, that the human population of our planet may increase to the point where only a starved and miserable existence is possible except for a small minority of powerful people.... Nothing is more likely to lead to an H-bomb war than the threat of universal destitution through over-population."[1] Calling for complete and universal disarmament, he wrote that if a hundredth of the expenditure on armaments was devoted to birth control it would have inestimable beneficial results.

At the end of his introduction Bertrand Russell put forward the following alternatives: (1) to "continue the reckless increase of population until war, more savage and more dreadful than any yet known..."; (2) to reduce the rate of population increase so as to provide "progress, rapid progress, towards the extinction of poverty, the end of war, and the establishment of a harmonious family of nations". The problem of population, he wrote, was therefore "the most important and fundamental; for

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[1] B. Russell. "Population Pressure and War." In: *The Population Crisis and the Use of World Resources*, ed. by Stuart Mudd, Dr. W. Junk Publishers, The Hague, 1964, p. 1.

until it is solved, other measures of amelioration are futile".[1] The paradox of his position was that in advancing rapid population growth as the root of all evil (in particular of the threat of war), this famous, sincere and dedicated campaigner for peace and disarmament thus hampered mobilisation of progressive forces for struggle against imperialism.

How common and influential modern Malthusian views are is shown by this symposium, published by the World Academy of Arts and Science[2] and containing papers and statements by statesmen and politicians, public figures and scientists in various fields, mainly from the United States. In the editor's preface it is said that no international organisation and no progressive government could "pass by this crisis of our time with averted eyes" but that there was "hope if we will openly face the problems".[3]

An illustration of the "scientific objectivity" of the symposium was the extract given from an address by the former US representative at the United Nations, Adlai E. Stevenson, to the annual banquet of Planned Parenthood-World Population in New York in 1963: "...discovery of some of the secrets of the atom has put such destructive force into the hands of the great powers that the whole purpose of armed struggle is becoming meaningless... scientific discoveries have so extended the average span of life that population growth threatens to frustrate all our costly efforts to achieve significant improvements in living standards."[4]

In a paper in the same symposium, Sir Julian Huxley expressed a conception close to Bertrand Russell's. He considered that the high birth rates in developing countries were hampering progress in industrial countries too; that the United Nations and its agencies should regard the population problem as a major and urgent problem to be resolved already now and that science should be

[1] *Ibid.*, pp. 1, 5.

[2] The members of this Academy include scientists from capitalist and developing countries on all continents; in addition, they include a sociologist from Poland and a microbiologist from Czechoslovakia.

[3] *The Population Crisis and the Use of World Resources*, ed. by Stuart Mudd, p. x.

[4] *Ibid.*, p. xiii.

working to find effective methods of birth control. He attributed all the phenomena of the crisis of modern bourgeois society to overpopulation without attempting to penetrate to the socio-economic causes of this crisis.[1]

Most of the papers in the symposium exuded a spirit of pacifism; and in some of them there were more or less disguised anti-Marxist sallies.

Let us consider some of the characteristic aspects of the most important contributions to present-day socio-demographic problems, especially R. C. Cook's methodological paper "Design for a Planet", which attempted to justify a biological approach to them.

"...The concept of ecology," he wrote, "seems simple enough to win acceptance.... Ecology undertakes to unravel and understand the total interactions of all organisms—plants, animals, and man—with each other and with their environment."[2] "Consider," he wrote, "four basic factors in the ecological complex: space, air, water, and people.... The multiplication of people is already changing this, and for the worse....

"Violation of the ecological balance evokes even heavier penalties than physical inconveniences and health hazards. It strikes at the very basis of human culture and civilisation."[3]

Thus Cook, who was editor of the *Population Bulletin*, considered that men lived outside society, and that population was the sum total of the biological creatures whose fate depended on the "ecological balance". Here we are dealing with open biologising of social phenomena.

In another contribution to the same symposium, on population and food supply, Cook expressed himself more circumspectly, and while preserving a Malthusian position, recognised the importance of socio-economic factors.[4]

In addition to the views of other official spokesmen, the symposium included a contribution by Eugene Black, former president of the International Bank for Recon-

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[1] *The Population Crisis and the Use of World Resources*, ed. by Stuart Mudd, pp. 6-11.

[2] *Ibid.*, p. 422.

[3] *Ibid.*, p. 423.

[4] *Ibid.*, pp. 451-77.

struction and Development, one of the biggest international financial institutions. "The industrialised countries," he wrote, "have shown their willingness to help. Common humanity and self-interest alike impel them to do so.... [But] population growth threatens to nullify all our efforts to raise living standards in many of the poorer countries."[1]

Alfred Sauvy, who developed his views in his *Malthus et les deux Marx*, also took his stand on the danger to the world from overpopulation.[2] The aim of his book was to make a political evaluation of the present time depicted as an epoch of demographic revolution. The decisive problem, according to him, is not the struggle between socialism and capitalism, or the fight against imperialism and neocolonialism, or what road countries liberated from colonialism will take, but the demographic problem of overpopulation of the planet.

His main idea was that the present times have allegedly proved Malthus to be right. This paradoxical conclusion was possible because he set out from a Malthusian position of the determining role of the demographic factor in social development, and counterposed Mao Tse-tung's false schemes and conceptions of social development to the propositions of Marxist theory.

The critical attitude of certain Western scientists to Malthusian positions is evidence of the interest of bourgeois scientists in the population problem and the influence of Malthusianism. Thus we find a critique of Malthusianism in Barnett's *The Human Species*, already referred to. Barnett considers that pessimistic predictions of the serious consequences of rapid population growth—food shortage—repeat Malthus' forecasts. But in his view Malthus' "theory" and "forecast" have on the whole been refuted by reality. Hundreds of millions of people are suffering from chronic hunger and lack of food. But how are the Earth's resources being employed? Possibly 34 per cent of its land area was cultivable, he said, but only 10 per cent actually was, and only 4 per cent for food. While recognising the serious situation in many countries

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[1] *Ibid.*, pp. 70-71.

[2] Alfred Sauvy. *Malthus et les deux Marx. La problème de la faim et de la guerre dans le monde*, Editions Denoël, Paris, 1963.

as regards food and hunger, it must be said, he wrote, that even in countries with very high food production a considerable part of the population was underfed. Application of the advances of modern science could ensure rapid progress. If they were not applied it was not because of the unalterable nature of man but was the fault of the modern world, i.e., of the capitalist system. Barnett cited the huge arms expenditure of Great Britain and the United States. Only careful long-term scientific planning, he considered, could ensure a proper ratio between population and food for a long time. In order to utilise the modern advances of sciences it was necessary to eliminate the class inequality that existed in most countries.[1]

The influence of Malthusianism was felt, mainly in disguised form, in the international conferences on population held in Belgrade in 1965 and in London in 1969. Analysing the work of the Belgrade conference, D. I. Valentey wrote: "A big group of bourgeois sociologists, economists, and demographers, who did not formally subscribe to Malthusianism, are now coming forward with a new population theory—of the 'vicious circle' of poverty."[2] The authors of this theory, he showed, took their stand on demographic determinism, which is a characteristic feature of Malthusianism. In other words, the Malthusians at Belgrade did not adopt the biological conception of population growth that some writers think the main feature of Malthusianism as their standpoint but a conception of demographic determinism that considers population growth mainly responsible for the backwardness of developing countries.

The principal features of "classical" Malthusianism are thus the following: (1) the proposition that population growth is the determining factor in socio-economic development, and creates overpopulation, and hence poverty, hunger, unemployment, wars, etc.; (2) a biological, unhistorical interpretation of population growth; (3) propaganda for birth control as the main condition for eliminating the socio-economic backwardness of developing countries.

[1] See Anthony Barnett. *The Human Species*, New York, 1967.

[2] D. I. Valentey. *Teoriya i politika narodonaseleniya* (Theory and Politics of Population), Moscow, 1967, p. 171.

At the present time, with far-reaching socio-demographic, sociological, public health, and psychological research into natality and mortality in progress, the majority of bourgeois scientists, and especially demographers, deny the purely biological character of population growth and recognise the effect of socio-economic factors on it; but at the same time they do not break completely with the Malthusian legacy and continue to consider population growth the most important cause of poverty, hunger, and the danger of war, i.e., adopt a stand of demographic determinism. There are various nuances among them as to the degree of exaggeration of the role of demographic phenomena and of underestimation of the socio-economic ones; some consider birth control the most important way of tackling today's economic problems, although they do not deny altogether the role of socio-economic factors in solving these problems; but they consider socio-economic problems abstractly and unhistorically, ignoring the significance of the socio-economic formation, and adopting the standpoint of the "vicious circle" theory of poverty. They therefore objectively do Malthusianism's main job for it, i.e., that of diverting attention from the struggle against class and national oppression, from the fight against imperialism and colonialism and for socialism, switching attention to demographic problems.

In the complicated political situation in which ideological struggle is now being waged, an oversimplified, one-sided approach to appraising the work of bourgeois scientists can do great harm. It is very important, therefore, to consider the various forms of Malthusianism, in particular on problems of the war danger. "The fact that not only opponents of a peaceful settlement of international disputes, but also supporters hold a scientifically inadequate position obliges us to conduct the scientific dialogue and polemic with them particularly carefully and in a well-argued way."[1] This proper attitude is very important when treating demographic problems; and here a differentiated approach is called for: the ideology of neocolonialism of Bouthoul and Vogt is one thing,

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[1] *Problemy voiny i mira* (Problems of War and Peace), Moscow, 1967, p. 5.

and the Malthusian errors of a stalwart champion of peace like Bertrand Russell another. With a differentiated approach to adherents of the conception of demographic determinism as a source of war, poverty, and hunger, it is necessary to criticise the conception scientifically and to discover the true sources of these calamities, viz., imperialism, neocolonialism, and the danger of distracting attention from them by Malthusian ideas.

Marxists do not deny the role of population growth in social development but consider that each socio-economic formation has its own population laws, and that the processes of reproduction and population growth depend on a complex set of socio-economic, historical, and biological factors and possess a certain autonomy. Marxists think that only a radical reconstruction of the economies and cultures of developing countries can do away with hunger and malnutrition and guarantee the cultural life and well-being of the working people of those countries.

Saying that, however, does not mean to belittle the problem of their population growth. Propaganda for conscious maternity must play a major role in the solution of this problem; but its inculcation encounters very great obstacles in view of the illiteracy of the hundreds of millions of people of those countries, and the tenacity of religious and other prejudices and of traditional views on marital and family relations, and of age-old traditions of large families; and also in view of the high infant mortality, demand for child labour, and so on. Drs. Guzevaty and Urlanis and other Soviet writers are right when they say that measures to encourage conscious maternity will be the more effective the more they are based on a progressive socio-economic policy, the eradication of illiteracy, the raising of general culture and hygiene, the emancipation of women, progressive legislation, and so on. This is brilliantly demonstrated by the book of the Indian sociologist D. Banerji on family planning.[1] One should not, of course, wait until industrialisation, higher culture, etc., will automatically lead to a lowering of natality. In addition to a progressive socio-economic

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[1] D. Banerji. *Family Planning in India. A Critique and a Perspective*, New Delhi, 1971.

policy it is necessary to carry on active propaganda for conscious maternity, and to acquaint the public with the ways and means of preventing conception, while at the same time combating a Malthusian appraisal of these measures.

Marxists oppose demographic determinism and all attempts to divert attention from the socio-economic path of tackling the current problems of developing countries, and all attempts to define the "demographic path" as decisive. In addition, Marxists are against a nihilistic attitude to an active population policy; such an attitude, especially to birth control, is particularly improper when rapid population growth is exacerbating the grave economic position of these countries, and their governments think a policy of birth control economically desirable.

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Chapter 2

SOCIOLOGICAL THEORIES OF POPULATION

B. Y. Smulevich, D. Sc. (Med.)

Sociological and demographic theories occupy an important place in modern bourgeois interpretations of population growth and development. Among them should be noted the "organic" racist theory of population and anthropological trends.

The organic theory. Already in the nineteenth century Herbert Spencer had put forward the social Darwinist idea of men's "struggle for existence" as one of the principles of his organic theory of population.

In modern times this theory has been modified. Now the "theory of human relations" plays a major role, the aim of which is to demonstrate that the working class is moving from alienation to integration in the general social order. In this regard the thesis advanced by the well-known American physiologist Hans Selye, author of "stress theory" and of a modification of the "organic theory of society", presents interest. Selye points out that the conclusions from his "stress theory" are more important for the "philosophy" of social life than for the physiology of the individual's illness.

Human society, he wrote, is like the human organism. Man is a multicellular organism whose cells depend on one another. Within a single organism there is no room for struggle and competition. The same is true of human society; its evolution is reflected in the interdependence of its units, which are specialised in various industries

and occupations. Joint co-operation in human society, he said, is much less perfected than in the human organism. Harmony or disharmony in social relations depends on the central nervous system, on people's mentality. A feeling of appreciation in people's mutual relations is the best guarantee of their health and prosperity, and of the creation of healthy "human relations" corresponding to the laws of nature.

Thus we have here, the psychologised organic "theory" of society "argued" in a new way, but derived from the conception of "human relations" rather than of "struggle for existence", a theory opposed to class struggle, a theory of class peace. Whereas Herbert Spencer justified class differences as the result of the "struggle for existence", Selye comes out for class peace, since nature is the creator of harmony and so the life of human society must be based on peaceful "human relations".

Conceptions of "human relations" derived from biology and religion occupy a notable place in the work of religious philosophers and sociologists, and in the statements of leaders of the Roman Catholic Church, and so on. The theory of solidarity opposed by religious ideologists to the Marxist theory of class struggle is derived from an organic conception of society. Its main principles are justification and substantiation of social inequality and class oppression, defence of private property, and the preaching of class peace and collaboration.

It is not by chance, therefore, that the German theologian Anton Retzbach wrote that class and social differences were a matter of nature.[1] The same sort of thing is said by Dante Germino, who affirms that "such an ordering of human relations is an embodiment of the natural law".[2]

Nowadays Teilhardism is widely current. It claims to create a new system of humanism of the future on the basis of a "third way". Teilhard de Chardin pictured human society as structured on the essence of man's biological and physiological features, as "the world

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[1] See A. Retzbach. *Die Erneuerung der gesellschaftlichen Ordnung*, Freiburg, 1932, pp. 58-59.

[2] Dante L. Germino. Two Types of Recent Christian Political Thought, *The Journal of Politics*, University of Florida, 1959, **21**, 3:458.

physiology of the organism", which included all humanity united on a world-wide scale. He considered that biological civilisation signified the socialising of all the natural human entities of our planet into a single organism that did not know class, national, or racial differences, into a single planetised humanity. This planetisation was, he said, a continuation of the evolutionary process by means of which the zoological type of man was singled out in the past. This biologism, which completely ignores the specific laws and patterns of social life, has been built up by its adherents as the main achievement of the Teilhardist conception, because, in their view, the common factor of progress can only be found in the biological aspect of human nature.

As Frederick Engels demonstrated, all man's biological possibilities could only be realised through labour. "Labour created man himself."[1] The origin of man and of human society meant the appearance of a new, higher form of the movement of matter—the social, the laws of which play a decisive part in the evolution of man and of human society without eliminating the effect of the laws of lower forms of motion, but modifying them to a certain extent.

Anthroposociology. Underlying anthroposociology is the conception that the racial properties of a population determine all aspects of social life, the structure of the population, and its culture, migration, health, scholastic progress, and so on. Today racialists endeavour to use facts that have a semblance of objectivity for their own purposes, especially attempts to appraise innate capacity by level of knowledge.

Such a method is pseudoscientific because abilities and knowledge are the products of development, which occurs during upbringing and education, and through concrete activity. The results of the development of capabilities are quite different in different conditions of upbringing and education. The aim of the pseudoscientific method of interpreting tests by all sorts of examiners' tricks is to hide that principal fact.

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[1] Frederick Engels. The Part Played by Labour in the Transition from Ape to Man. *Dialectics of Nature*, p. 270.

Race theory, as we know, became the official doctrine of the German fascists, for whom it served as the justification of the fascist dictatorship and its gangster home and foreign policy. Leading pillars of Nazi race theory have raised their voices again since the war.[1] Today neo-nazists, however, use racism and the biologisation of social phenomena in disguised form. Thus we find an article "Biopolitics, Fulfilment of the Laws of Life" by one Arthur Ehrhardt in the West German journal *Nation Europa*.[2] The author tried to solve the most complicated questions of contemporary international affairs by applying genetics to politics. Making a show of simultaneously opposing imperialism and the "dictatorship of the proletariat", "Bolshevism", he wrote that biopolitics, in contradiction to the plans of East and West, served the future of all mankind. Presenting the Marxist theory of society as the "Marxist-Michurinist theory" by which an "unblemished human species" could be raised by creating an unblemished social environment, Ehrhardt "refuted" it by genetics. Inherited characteristics and combinations of genes, he said, moulded the environment and not the other way round; and by primitive biologisation of social phenomena he tried to picture genetics as the way to resolve all urgent social and political problems.

Many progressive bourgeois scientists have spoken out against racist and other biological "theories" that attempt to justify differences in the positions of classes and nations biologically. For the wealth of facts gathered by ethnologists, anthropologists, geographers, and others, absolutely and convincingly refutes fables about the natural backwardness and intellectual "inferiority" of the "coloured and culturally backward nations".[3]

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[1] After the war the UN Economic and Social Council set up a committee of leading anthropologists and geneticists, who published an anti-racist declaration in 1951. The notorious ideologists of German fascism, E. Fischer and F. Lenz, spoke out against it.

[2] Arthur Ehrhardt. Biopolitik—Vollzug der Gesetze des Lebens, *Nation Europa*, Coburg, 1964, 12:3-9.

[3] In his *Africa to 1875* Robin Hallett writes: "Moving backward to the remote era of paleolithic man, the comparisons change dramatically, for then Africa was the centre of human activity, technical invention, and development" (p. 15). Neither in antiquity nor in the tenth to fourteenth centuries was Africa considered backward

The example of the building of socialism in the USSR alone convincingly demonstrates how peoples can evolve when liberated from capitalist oppression. Millions of facts show that there are no "racial" boundaries to man's development and that racist inventions about the "intellectual inferiority" of nations are a completely exposed slander.

Bourgeois sociological theories of population are extremely contradictory. On the one hand they criticise the positions of Malthus, Spencer, and the social Darwinists; but on the other hand, bourgeois sociologists, while recognising the decisive importance of social factors in demographic processes, do not accept the concept of a socio-economic formation. They replace the concept of classes by a vague concept of social stratum. They depict the antagonistic contradictions of capitalism as those of industrial society as well; social problems are non-class problems for Gerhard Mackenroth, the West German demographer and one of the authors of the sociological theory of population growth: unemployment and agrarian surplus population are not, in his view, social problems but organisational ones, industrial problems. While opposing racist anthroposociology Mackenroth preaches an "elite theory". In his view, it is not capitalist relations but industrial society as such that is undermining the basis of the family.

Not all sociological research in the field of theoretical analysis of population growth, however, is so openly tendentious. The work of the American sociologist and demographer James Beshers has a broader sociological approach to analysing demographic problems, but it is based on the eclectic bourgeois theory of factors of production, and therefore interprets Marx's theory of population incorrectly.[1] Contrasting the views of Marx and Malthus,

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in its development. Only since the end of the fifteenth century did the marked lagging of Africa behind the countries of Europe begin. And that period, as we know, was the beginning of the slave trade, which threw the continent far back. Hallett writes that the history of the development of civilisation began earlier in Africa than on any other continent (Robin Hallett. *Africa to 1875. A Modern History*, The University of Michigan Press, New York, 1970).

[1] See James M. Beshers. *Population Processes in Social Systems*, New York, 1967,

Beshers wrote that the victory of socialist revolutions increased Marx's authority as a "social prophet" but gave his critique of Malthusianism the character of a dogma.

Beshers devoted a great deal of attention to social psychology, correctly remarking that it was unsatisfactory, when analysing a population's reproduction processes, to tie them up in general with the phenomena of industrialisation and urbanisation, and that it was necessary to study the concrete refraction of the whole sum of social factors, in particular the psychological ones, in the concrete micro-environment (i.e., in the family). In general he devoted his main attention to psychological factors in problems of reproduction and migration. As regards the social factors, he wrote that their effect on demographic processes was very complicated to take into account, since they were constantly changing. Without a Marxist, historical, class analysis a scientific explanation of the impact of social factors on demographic processes is impossible. Beshers' book confirms what was said above, that the sociological research of bourgeois demographers is clarifying many interesting concrete phenomena and links between the factors in demographic processes, but is unable to provide an integral sociological analysis of the processes of population growth and development.

Chapter 3

THE APOLOGETIC ROLE OF MODERN BOURGEOIS DEMOGRAPHY

A. P. Sudoplatov, Cand. Sc. (Econ.)

In the works of bourgeois authors the initial theoretical premises for analysing population increase find direct reflection in fundamental and applied research into demographic problems in Western Europe and the United States. This research, especially study of the socio-economic consequences of various rates of increase, has been considerably broadened in recent years. According to UN data, there were more than 230 research institutions and organisations in the world in 1970 concerned with treating and studying various aspects of demographic processes and family planning.

In 1954 there were only twelve specialised institutions concerned with complex study of population problems; by 1970 there were already 113. In the United States alone in 1969-71 private and public organisations spent more than 180 million dollars on financing various projects in the population field, including around twenty million dollars on studying problems of world population and on training specialist demographers for developing countries.

The economic and political crisis of capitalist society and the special features of the demographic situation in capitalist countries since World War II have caused a certain evolution in traditional bourgeois views on population. In particular we must mention the attempts to interpret demographic processes on the basis of Keynes-

ian and Neo-Keynesian doctrines of economic dynamics, theories of "stages of economic growth" and of the "new industrial society", and so on. A major manifestation of the crisis of bourgeois science is the practical refusal of modern bourgeois demography to treat the theory of population in a broad way.

An illustration of this refusal is the evolution of the definition of the subject matter of demography given in the symposium *The Study of Population* edited by the American demographers Philip M. Hauser and O. D. Duncan.

Instead of the definition of the subject matter of demography common in the 1930s and 1940s as "understanding of human populations and their general movement", modern bourgeois demography defines its field as "the study of the size, territorial distribution, and composition of population, changes therein, and the components of such changes, which may be identified as natality, mortality, territorial movement (migration), and social mobility (change of status)".[1]

In bourgeois demographic science such a definition bears the stamp of the traditional striving to consider demographic processes solely in concrete form, outside their socio-economic and historical conditions, which in the end excludes real understanding of them. It pursues the aim of stressing the autonomy of demographic processes, of reducing the theory of population to an analysis of the linkages between the main demographic indices. The roots of such an approach are in Keynesian and Neo-Keynesian conceptions of the place of population in the economic and social development of society, according to which population is an "autonomous factor of economic growth"[2] with a "decisive significance" for social development. As a matter of fact, we meet a repetition here of the main Malthusian assumptions proceeding from the fact that all the social and economic upheavals of human civilisation are explained by population growth. Such an obviously false initial position makes it possible to

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[1] Philip M. Hauser and Otis Dudley Duncan (Eds.). *The Study of Population. An Inventory and Appraisal*, The University of Chicago Press, Chicago, 1959, p. 2.

[2] Alvin H. Hansen. *The Postwar American Economy. Performance and Problems*, New York, 1954, pp. 23-34.

conclude that there is a disparity between the economic structure and the changed reproduction regime in both industrial and developing countries.

In striving to answer how far population growth and movement affect the general course of economic development, the bourgeois economists J. Meade, Alvin Hansen, and others assert that, in connection with the disappearance of opportunities for further geographical expansion of industry and the slowing down of the rate of increase of the populations of Western Europe and the United States, in a situation of developing scientific and technological revolution, the present level of capital accumulation does not correspond to population growth.[1] Only the external relation between reproduction regime and the amount of accumulation is pushed to the foreground here. And in addition, this relationship between the size of a population and its structure is only analysed within the framework of the relations between its size and the volume of the market.

In actual fact, understanding of the relationships involved is only possible from an analysis of the dynamics of capitalist industry and taking its driving motives into account. Capitalist enterprise obtains maximum profits not when production corresponds to the level of consumer demand but when, given sufficient effective demand, the population experiences a lack of certain goods. Making use of this, and of their monopoly position on the market, entrepreneurs sell their products at prices most profitable to them. The position of the bourgeois demographers who interpret demographic processes as indissolubly linked with the movement of consumer demand, although it provides an opportunity of measuring all the components of final demand quantitatively (and also of estimating the "contribution" of population growth to the creation of national income) on the basis of Cobb-Douglas' "productive function", makes it impossible to determine the balanced character of extended reproduction. Thus analysis of the dynamics of reproduction of the population is divorced in practice from analysis of the relations of production, which blurs the

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[1] J. Meade *et al.*, Demography and Economics, *Population Studies* (Supplement), London, May 1970, pp. 25-31.

real picture of the linkages between economic and demographic processes.

Surmounting of the disparity between the level of economic development and the size and structure of the population is also considered by bourgeois theoreticians within the limits of schemes of active resettlement of population and differentiated stimulation of the flow of labour from industry to the services sphere.[1] In other words, it is a matter of adjustment of the resettlement of population and the movement of migratory flows and the use of the active fraction of the population, i.e., of manpower reserves, to the needs of the economy influenced by the consequence of low or, on the contrary, high, rates of population increase.

The fundamental inadequacy of these assumptions is that the "apparent linkage" of the economic and demographic processes is looked upon only in its external form and is formulated in certain abstract conditions of economico-demographic and regional equilibrium. At the same time, searches for the optimum "national income-population growth", "population density-income", and "age structure-income" rates are undertaken on the basis of the false Malthusian methodological premise that the interaction of population growth and economic development is based on a certain general ratio between population and the available means of subsistence.

One cannot deny the definite interest that the use of economico-mathematical methods presents in principle for tackling the concrete tasks facing us in the field of population research. In particular, economico-demographic modelling can help determine what fraction approximately of the national income must be spent on demographic investment in developing countries to prevent a fall in the living standard as a consequence of high rates of increase of the population. But progress in applying economico-mathematical methods is predetermined by the economic and political analysis of population problems; and that calls for a firm scientific, methodological foundation and is incompatible with the reactionary class position of bourgeois science.

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[1] *Government Financial Aids to Geographical Mobility in OECD Countries*, Paris, 1967.

What has been said can be confirmed by certain estimates relating to developing countries whose demographic problems have especially concerned bourgeois scientists in recent years.

According to UN estimates, satisfaction of the needs of the growing population with an annual rate of increase of 2.5 per cent (which corresponds approximately to the present demographic position in developing countries) requires more than three-fifths of the national income, so that less than two-fifths remain to increase the accumulation fund or raise living standards. Basing themselves on these estimates bourgeois demographers draw far-reaching conclusions about the so-called optimum reproduction regime for developing countries (by optimum is understood population growth rates permitting maximisation of per capita income).

This criterion of optimality seems quite unacceptable to us, and unsound for both capitalist and developing countries. By abstract arguments about the fraction of savings in the national income and the level of consumption, bourgeois theoreticians strive to get around the root problem of the concrete distribution and redistribution of national income among all strata of society. The main point disappears from view, namely, that this distribution, under capitalism, has a clearly expressed antagonistic class character. Certain authoritative specialists in demography, incidentally, like R. Pressat, have pointed out the lack of foundation of the "attractive conception of optimum population" and its vagueness and indeterminateness for finding the scale of the desirable population.[1]

The calculations of the possible structure of national income with various rates of population increase made by J. Henripin of the University of Montreal are of interest. In his view, given simple reproduction of the population, mean annual national income growth rates up to 4.8 per cent are possible for Canada, with aggregate cumulative capital investments totalling 19.3 per cent of the national income. Henripin illustrated the consequences of a mean annual population growth rate of 2.3 per cent, which called for increasing demographic investment up to 6.9 per cent of the national income,

[1] See R. Pressat. *Population*, London, 1970, p. 103.

and aggregate capital investment to 21 per cent.[1]

In discussing the practical value of such exercises it is necessary to draw attention to the tendency noticeable in the ruling circles of the leading capitalist countries to take demographic factors into account when formulating and drafting medium- and long-term socio-economic policy. Evidence of this, in particular, is the work in 1970-72 of the US Congress' special commission on population, whose terms of reference were to study ways of adapting the American economy and society as a whole to the changing size and location of the population.

These beginnings of the gradual delineation of another trend in state-monopoly regulation of the economic and social affairs of society are still undoubtedly only just the first steps; yet it would be wrong to underestimate this obvious increase in the attention being paid by US ruling circles to complex investigation of population problems and to practical application of the results of research in the interests of monopoly capital.

This circumstance is objectively pushing bourgeois demography to improve its treatment of the social problems of population growth. It is not surprising therefore that it has been the sociological trend in demographic research that has been most intensively developed in recent years. And modern Malthusians are grouping themselves around the so-called social interpretation of changing reproduction regimes.

Present-day Malthusians and Neomalthusians of various shades are united, above all, by a striving to regard maximum, minimum, and optimum ratios between population and available mineral, raw material, and food resources as the initial factors in reproduction and population growth. The most outspoken theoreticians of this trend write that life confirms Malthusian positions, and counterpose the "rich" countries from this angle to the "poor" countries. Humanity's chances of "survival", about which Neomalthusians love to prate, rest completely, in their view, on the possibilities of coping with the unprecedented "population explosion" that has occurred for the first time in all history.

[1] *Ibid.*

An example of typical Neomalthusianism is *The Doomsday Book* by the English sociologist Griffith Taylor, which appeared in London in 1970. Its author prophesied the death of mankind in the next thirty years through overpopulation of the planet, exhaustion of mineral and food resources, and the harmful effects of scientific and technical advance, leading to pollution and contamination of the atmosphere and water supplies.

The unsoundness of these prophecies lies in their abstract, non-social interpretation of scientific and technical progress. It is not population growth or scientific and technical progress, but the rapacious utilisation of the latter in capitalist countries, caused by the drive for maximum profits, and the unreality of imperialist states' establishing effective control over private enterprise corresponding to the interests of society, that is leading to deterioration of the workers' position, mounting air pollution, escape of toxic chemicals, and the poisoning of water supplies. The general theoretical propositions of bourgeois science also cause a corresponding selection, and in a number of cases adjustment, of the facts of demographic statistics, the pushing to the fore of the extremely high density of population in certain areas and the unfavourable age structure of the population in developing countries.

In 1950-60 there was a considerable vogue for attempts to explain the changing population of the world and of separate countries by means of the concept of "demographic transition" put forward in 1945 by the American demographer F. Notestein. The kernel of this concept can be summarised in essence in the three stages of "demographic evolution" suggested by Notestein: viz. (1) the final completing stage of demographic transition, characterised by a low or nearly zero rate of natural increase; (2) a stage of demographic transition in which mortality is reduced much faster than natality grows; (3) a stage of potentially high increase characterised by increase of natality with a stable high death rate. Later Notestein wrote that the stages of demographic transition outlined by him were based on study of the quantitative changes that took place in Europe from the end of the eighteenth century to the middle of the twentieth.[1] The

[1] F. Notestein. In: *The Population of the World in the Year 2000*

same point of view, though slightly modified, on the character of the quantitative changes in demographic processes has been expressed by the French demographers Alfred Sauvy and A. Landry.[2]

Notestein, Sauvy, and Landry also stressed the significance of social factors in population development, and were inclined to see in them, especially in urbanisation, the main cause of the lowering of the rates of natural increase in European countries and in the United States in the first half of this century. On that basis Notestein's scheme is a sort of demographic reflection of W. W. Rostow's theory of "stadial economic growth".

At first glance this posing of the problem gives grounds for counterposing it to the traditional Malthusian conceptions of overpopulation and the primacy of the biological elements in human reproduction. In fact, however, there are no grounds for doing so. Notestein and his supporters are united with the Malthusians by common initial assumptions that the social problems arising in the modern world allegedly have a general character that does not depend on the social system, and that they are not the specific outcome of antagonistic formations. Notestein and Sauvy, and the acknowledged Malthusians who see in Malthus' theory a general "tool of analysis", therefore have quite a few theoretical arguments directed toward whitewashing capitalism and demonstrating that it can be delivered from its defects and contradictions by growing over into the "post-industrial society". Adherents of the theory of "demographic evolution" thus willy-nilly join forces with Neomalthusian outlooks on the role and place of population in social development.

The limited nature of the conception of demographic evolution does not lie simply in its abstract arguments about the part of social factors in population development in general. Absolutising of the demographic processes in Europe in the eighteenth to twentieth centuries does not even provide an opportunity for an adequately substantiated empirical generalisation of the demographic situation for the future. Population forecasts built on "European experience" from the past have therefore proved unrealistic.

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in Demographic Analyses, ed. by J. Spengler, New York, 1957.

[2] See Alfred Sauvy, *Théorie générale de la population*, Vols. 1, 2, Paris, 1952, 1954.

More recently study of the psychophysiological foundations of fertility has acquired a particularly wide vogue in bourgeois demographic research. In the United States, for example, around a third of the annual budgets of all centres studying population is being spent on this end. The bulk of the research has a purely applied character, being related to the field of physiology. But there are, at the same time, a number of theoretical publications in which an attempt is made to draw conclusions from the difference in levels of fertility in families in different social groups.

The initial methodological premise of these works is affirmation of the predetermining influence of fertility on the scale of population growth. In that connection the authors try to bring out the psychophysiological factors determining the level of fertility, and to establish their effect on the social environment. This kind of work is based on a disguised attempt to smuggle biological laws into social development. It is wrapped up in a fog of arguments about the transformation of people's psychophysiological behaviour into a general social model of population, and a need to review the metaphysical structures for understanding free human activity.

The tendency of bourgeois demography, like bourgeois political economy, to keep "pace with the *real* development of the social contradictions and class conflicts inherent in capitalist production"[1] is realised within the narrow limits of the bourgeois outlook. Because bourgeois theoreticians, shut in within abstract apologetic schemes of the "pressure of growing population" and of "active redistribution of population", do not consider the real causal links and dependencies between socio-economic and demographic processes, which are ultimately due to the character of the social organisation of human society, and therefore cannot correctly characterise the actual role and place of population in social development.

[1] Karl Marx. *Theories of Surplus Value*, Part. III, Moscow, 1975, p. 501.

The Theory of Population is a symposium in which demographers and social scientists from the Soviet Union, Hungary, Poland and the German Democratic Republic have contributed and treated population problems and aspects of demography from a Marxist standpoint.

The papers devote much attention to a complex, all-round approach to the study of population, and discuss the methodology of demography and methods of inquiring into demographic processes. The authors make a detailed and circumstantial review of current population problems and consider the demographic outlook for human society.